The fundamental purpose of labor legislation is the conservation of the human resources of the nation.

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Symposium on Diseases of Occupation.

Investigation of Industrial Diseases.

Health Problems in Modern Industry.

State Promotion of Industrial Hygiene.

Bibliography on Industrial Diseases.

JUNE, 1912

PROCEEDINGS OF THE SECOND NATIONAL CONFERENCE ON INDUSTRIAL DISEASES
ATLANTIC CITY, N. J., JUNE 3-5, 1912
American Association for Labor Legislation
Joint Session with American Medical Association

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AMERICAN LABOR LEGISLATION REVIEW

Vol. II, No. 2

ILLUSTRATIONS

AMERICAN LABOR LEGISLATION REVIEW

Vol. II JUNE, 1912 No. 2

CONTENTS

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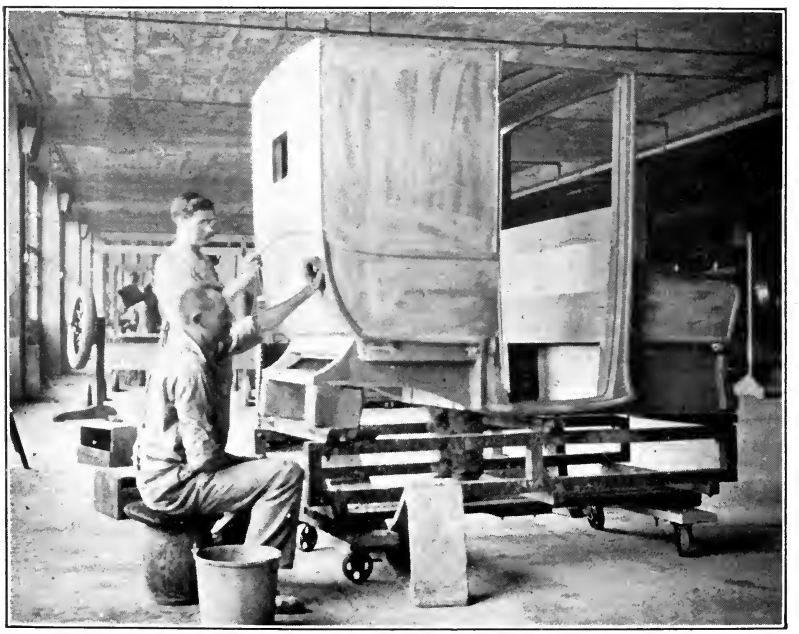
DRY SANDPAPERING

Dry Sanding of Paint is a Frequent Cause of Lead Poisoning. The Operation Fills the Air With Tiny Particles of Lead Dust



WET SANDING WITH PUMICE STONE

Dust is Avoided When Sanding is Done with Wet Pumice Stone

INTRODUCTION

When the American Association for Labor Legislation called the First National Conference on Industrial Diseases, in Chicago in June, 1910, it was possible only to mention the appointment of the first state commission on occupational diseases and to note the completion of an investigation of one industrial poison. That practically marked the extent of serious public interest in diseases of occupation, and the first conference attracted attention to this as to a new problem. Since then there has been a remarkable development of interest in the subject.

The Memorial on Occupational Diseases, prepared by a committee of the first conference, laid the foundation for and strongly urged national investigation of industrial hygiene. One after another eight states have since then passed the Association for Labor Legislation's standard bill requiring physicians to report all cases of certain diseases of occupation. The work of the one state commission, in Illinois, led to the enactment of a special occupational disease law requiring monthly medical examinations of workmen in a few of the most hazardous employments. In April, 1912, the United States Congress agreed, by passing the Association's bill placing a prohibitive tax on poisonous phosphorus matches, to abolish "phossy jaw", the occupational disease due to the one industrial poison which had then been thoroughly studied. In the meantime, the List of Industrial Poisons, prepared by the International Association for Labor Legislation and translated by the United States Bureau of Labor, gave definite direction to further investigations. Reports on industrial poisoning from lead and mercury have already been published, and medical inspection of factories has increased in importance.

The Second National Conference on Industrial Diseases, in Atlantic City, June, 1912, was attended by practicing physicians, state and federal public health officials, medical inspectors of factories, physiologists, investigators and statisticians, manufacturers, efficiency engineers, insurance experts, labor leaders, economists, and social workers. Through an industrial hygiene exhibit, the first extensive display of the kind in America, in-

dustrial processes dangerous to health and the effects of these peculiar work hazards, including such diseases as "phossy jaw", lead poisoning, arsenic poisoning, compressed-air illness and numerous occupational eye and skin diseases, were graphically placed before the audience. These photographs, charts, and drawings were realistically and effectively supplemented by stereopticon illustrations, made by the new process in color photography. Finally, through the medium of a joint session with the American Medical Association, that organization, for the first time in the sixty-six years of its existence, gave a place to the industrial disease problem on its annual program.

There is now scarcely a public meeting of importance for the discussion of any phase of the labor problem that does not include at least some mention of occupational diseases. Three federal bureaus are now making investigations in their own respective fields, and several state commissions, bureaus of factory inspection, and boards of health are at work upon the problem. The American Association for Labor Legislation has now published and distributed no less than forty papers and reports on occupational diseases and industrial hygiene. The publication at this time, through the cooperation of the Association for Labor Legislation, the Library of Congress, and the United States Bureau of Labor, of a special Bibliography on Industrial Hygiene, will make further researches less difficult.

The proceedings of the Second National Conference on Industrial Diseases, here made available in permanent form, should give a new impetus to the nation-wide campaign for the promotion of industrial hygiene. The members of the Association for Labor Legislation may well feel that by intelligent cooperation along definite lines they have made a promising beginning in the important work of conserving the health and lives of industrial workers.

JOHN B. ANDREWS, Secretary,
American Association for Labor Legislation.

I

SYMPOSIUM ON INDUSTRIAL DISEASES

Joint Session with the American Medical Association

Presiding Officer: Rupert Blue
Surgeon General, United States Public Health and Marine Hospital Service
Washington, D. C.

CLASSIFICATION OF OCCUPATIONAL DISEASES

W. Gilman Thompson
Cornell University Medical College.

In order to establish a satisfactory classification of the occupational diseases and the industrial hazards which give origin to them, it is necessary to agree upon a standard nomenclature which may prove not only of scientific value, but constitute a working basis for such remedial legislation as may prove desirable. The authority for such nomenclature and classification is properly vested in the United States Bureau of the Census which, being a national institution, is better fitted for this work than the local municipal or state boards of health or labor bureaus. Agreement as to uniformity among the latter would obviously involve much time and discussion, with probably less satisfactory ultimate results.

The Bureau of the Census already furnishes a generally accepted classification of the causes of death from ordinary diseases and includes a number of causes of death from occupational diseases, about one hundred of which are enumerated in the Mortality Statistics Bulletin No. 108, 1909, p. 33. But this list is obviously merely tentative, else why should the making of neckties be included as hazardous and the caisson disease be omitted, of which, in the admirable report of Dr. F. L. Keays, twenty fatal cases are recorded as occurring within a few years in New York City alone? Fortunately, the Bureau of the Census is at present cooperating with the Committee of the American Medical Association on the Nomenclature and Classification of Diseases, and it is to be hoped that they will find time to include in this work the formulaton of a complete classification of the disease hazards and deleterious substances which are causatively related to the industrial diseases,—irrespective of mortality statistics. As far as these diseases are themselves concerned, they are fairly well named and classified already, but not in connection with their causation. For example, arteriosclerosis or chronic nephritis due to chronic lead poisoning do not differ materially from the same diseases originating from

syphilis, chronic alcoholism, gout and other etiological factors. Nor does a bronchitis due to inhaling dust in a cotton mill differ essentially from that acquired in other ways. In fact, apart from the lesions of the caisson disease, and a few of the bone lesions, occupational tics and palsies, there is little that is new in those of the diseases of hazardous industries, and little which cannot be included in existing medical nomenclature as applied to disease in general.

A. Harmful Substances

The injurious substances employed, however, present a somewhat more complex problem, mainly because their number is rapidly increasing, and any system of classification should be an elastic one, permitting of extension and providing for a large miscellaneous group. For example, the great majority of injurious substances may be comprised under the six general headings: (1) Metal poisons, including the metallic salts; (2) toxic gases, vapors and fumes; (3) toxic fluids (such as acids and alkalies, petroleum products, etc.); (4) toxic or irritant dusts, subdivided into: (a) insoluble inorganic dusts (irritating the respiratory passages), (b) soluble inorganic dusts (liable to be swallowed and absorbed), (c) organic dusts and fibers; (5) organic germs (such as those of glanders and anthrax); and (6) miscellaneous irritants.

Under these major headings may be grouped practically all of the irritant substances, yet certain difficulties arise even in this elementary arrangement. For example, lead, which of course would be classed as a simple metal poison, is also, when heated, to be ranked among the toxic fumes, and again, in the form of filings, as a soluble inorganic dust. As this applies to many of the other metals, to repeat them all under each subheading would be cumbersome. Phosphorus, for instance, is a metal, yet it is as a toxic fume that it works such havoc, and it had better be classed with the latter.

Furthermore, the names of many substances may convey no intimation of their special hazards. For example, whether ferrosilicon be classed among the metals as containing iron and traces of arsenic, or as a liquid, since by itself it is non-toxic, neither of these groups would suggest its real hazard, which consists in the accidental access of water, producing the combination arseniuretted hydrogen gas that has cost many lives, especially on ships in which the ferrosilicon was being transported.

For such reasons, it would seem best to class each substance primarily in the major group which its most common form and use suggest, and, when its common name conveys no idea of the hazard, to indicate the latter in parenthesis. Thus ferrosilicon would be grouped under toxic liquids, and a parenthesis should follow, reading "(arseniuretted hydrogen gas, on hydration)".

B. Harmful Conditions of Physical Environment

The above general classification refers only to the material hazards, so to speak, and does not provide for the injuries arising from environmental or physical conditions, such as the air compression affecting tunnel and caisson workers and divers, the rarefied air affecting aviators, or the tunnel injuries to the ears. Nor does it provide for the injuries arising from excessive temperature changes as affecting smelter employees, stokers, workers in cold-storage, etc. A group, therefore, of hazardous occupations due to physical environment should be established, including hazards from excessive variations in (a) air pressure, (b) humidity, (c) air temperature, and (d) light (including electric light, the X-ray, etc.).

C. Injuries (Medical) to Nerves, Muscles, and Bones

Another general group of occupational hazards is necessary to comprise disease injuries to nerves, muscles, and bones, arising from such conditions as occupational strain, fatigue, repeated blows and vibrations, excessive pressure, repeated muscular contractions, and faulty positions assumed in working at benches, handling many forms of tools, etc. The large group of "occupational neuroses", with cramps, palsy, tremors, tics, neuralgia, neuritis, and vaso-motor disorders, should be included as subdivisions of this group. To this also may be added a subclass comprising insomnia, headache, general nervousness as from "speeding up", etc.

D. Injuries of Special Organs

Other primary groups of occupational diseases should include injuries of special organs: namely, (1) injuries to the skin; (2) injuries to the eyes; (3) injuries to the ears; and (4) injuries to the nose and throat.

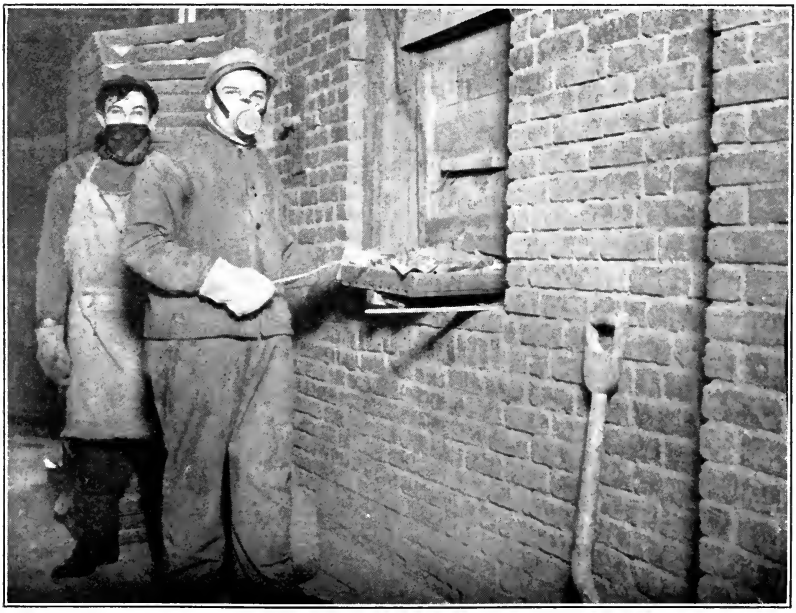
Under the foregoing general classification, with appropriate subdivisions, may be included all the specific causes of occupational diseases, namely, the (a) material, (b) chemical, (c) physical, and (d) physiological causes.

Classification of Hazardous Occupations

There remains to be dealt with the classification of hazardous occupations, which is, from every point of view, a far more difficult task. While it is true that some few definite occupations, like that of the caisson and tunnel workers, each produce a single definite disease from a single definite cause, very many industries are so complex as to give rise to many different hazards and as many different diseases. A classification which fails to make this clear fails of its primary object, and is not alone useless but may prove unfair as a basis for remedial legislation or scientific deductions. But to specify all the subdivisions of labor in a complex industry is to accumulate a catalogue of many thousands of technical terms and easily to become lost in a maze of phraseology. It is precisely in this understanding of technical work that physicians as a body need education, for upon them must devolve the collection of disease data, if such data are to be confirmed by accurate diagnoses. It is not customary, as yet, to give systematic instruction in medical colleges upon occupational diseases. Most of the standard textbooks on medicine refer to scarcely a half dozen of the industrial poisons, such as lead or arsenic, and the literature of this topic adapted for use in this country is scattered mainly in isolated monographs and a few brief journal articles.

One or two illustrations will serve to emphasize the difficulties of properly classifying the occupations involving disease hazards. If a workman be classed merely as a "potter" he may be employed in glazing or polishing and acquire lead poisoning; or, as in the Limoge works in France, he may be a grinder subject to inhalation of silica dust, and may acquire fibroid phthisis and subsequently tuberculosis; or as a molder he may be exposed to constant humidity and may suffer from rheumatism or chronic bronchitis. Obviously, to class him solely as a potter supplies information so incomplete as to be almost useless. Other terms are still more ambiguous. For example, a "hatter" may be engaged in the non-hazardous occupation of selling hats, may be a maker of straw hats, associated either with no hazard or with the minor one of using some bleaching substance or inhaling straw dust, or may be a man who is employed in making felt hats. This latter industry is so subdivided that the man may rank as a blocker, blower, pouncer, flanger, curler, shearer, stiffener, singer, trimmer, coner, dyer, dryer, feeder, hardener, mixer, welter, or

1.



2.

ARSENIC POISONING

1. Putting Paris Green Into a Bolter. An Old and Dangerous Method
2. A Comparatively Dustless Bolter. Respirators Worn as an Additional Protection

finisher. In about half of these labors he would be subject to no hazard whatever, as for instance if he be a curler or finisher; but if he be a fur-cutter, "maker" or sizer he is very susceptible to bronchial irritation and liable to add to the tuberculosis mortality. If, on the other hand, he be a pouncer he is almost certain to acquire chronic mercurial poisoning and sooner or later to become wholly incapacitated for work, and he may possibly die as a result of his labor.

In confirmation of the lack of information among manufacturers, or of their much worse willful neglect of the humanitarian interest which they ought to exercise, is the common observation of all who have made special investigations in lead poisoning that the manufacturers almost universally profess ignorance as to its existence, at least in their own establishments. Yet in New York State, Dr. John B. Andrews has compiled data of sixty cases of death from this cause occurring within the two years 1909 and 1910, and I have personally collected data from only two hospitals and one dispensary in New York City of over three hundred cases of lead poisoning so serious as to demand hospital treatment, and sometimes to produce permanent disability.

Before a standard classification of occupational diseases is adopted, attention should be given to the educational needs of the situation. A classification which is too elaborate may fail of its chief purpose, which is to interest physicians in this important humanitarian, scientific, and legislative work, i. e. the control and mitigation of the occupational disease hazards. It is desirable, therefore, to furnish physicians and employers with a simple general classification, after the form outlined in this article, and to supplement it with a more elaborate classification to be supplied to special investigators in hospitals and dispensaries, or to those who have access to the study of large groups of cases. It is clearly undesirable that hasty or unfair legislation, based on insufficient data, should be enacted, and it is therefore of the greatest importance that physicians everywhere enter into hearty cooperation with the state authorities in the collection of accurate statistics which shall be of true scientific value.

A beginning has been made in eight states by the enactment of laws requiring physicians to report six of the occupational diseases, namely, those due to four metals, lead, arsenic, mercury, and phos-

phorus, to one germ, the anthrax bacillus, and the caisson disease. This list will doubtless be extended considerably in the near future, and among the first additions should be wood-alchohol poisoning. This substance is used to dissolve the shellac for varnish which is often applied in confined spaces, such as the linings of brewery vats, where the alcohol fumes accumulate. There were two deaths and a case of permanent blindness from this cause in Buffalo recently, and three other deaths, the last one of which was diagnosed by the physician who was summoned as a case of "epilepsy", occurred in a brewer's vat in New York.

As an aid to meet the educational requirements of classification in New York State, I have furnished the state labor bureau with a brief general classification of occupational hazards and harmful substances, which is printed on the backs of the notification blanks required by law to be sent to each physician. I also furnished a more elaborate classification which is printed in small booklet form and is designed for distribution to hospitals and dispensaries, social service workers, and all physicians who will take interest enough to gather special data. As far as possible this classification is arranged in four parallel columns, headed respectively "Industry", "Harmful Substance", "Mode of Entrance", "Symptoms and Diagnosis."

For my own use and that of my assistants in hospital and dispensary work, I have designed history cards with headings calling for classified data, one set for the metal poisons, another for the dust and fiber irritants, etc. From such uniformly classified cards it is easy to compile scientific data for any particular group of diseases.

Conclusion

In conclusion, I would recommend (1) that the Bureau of the Census establish a uniform nomenclature and classification as complete as possible, to be used as a national standard; and (2) that the state labor bureaus or health boards issue a standard notification blank like the one in use in New York State, which is modeled after the national death certificate blank of the Bureau of the Census. On the back of this blank should be printed a brief working classification of the commoner occupational hazards and harmful substances, emphasizing in black letters the most important ones. And I would also recommend (3) that there should similarly be issued to all who will make use of it, a more comprehensive classification in booklet

form, detailing the symptoms in parallel columns with the injurious substances liable to produce them.

General Classification of Occupational Diseases and Harmful Substances

A. *Harmful Substances:*

1. Metallic poisons.
2. Toxic gases, vapors, and fumes.
3. Toxic fluids (acids, alkalies, dyes, etc.).
4. Irritant dusts and fibers.
   (a) Insoluble inorganic dusts.
   (b) Soluble inorganic dusts.
   (c) Organic dusts and fibers.
5. Organic germs (anthrax, glanders, etc.).
6. Miscellaneous irritants.

B. *Harmful Conditions of Environment:*

1. Air compression and rarefaction.
2. Excessive humidity.
3. Extreme heat and cold.
4. Excessive light (electric, X-ray, etc.).

C. *Occupational Injuries:*

(Medical)

1. Injuries to nerves, muscles and bones.
   (Strain, fatigue, cramp, faulty positions, "occupational neuroses", blows, vibrations, pressure, etc.)
2. Injuries to the eyes.
3. Injuries to the ears.
4. Injuries to the nose and throat.
5. Injuries to the skin.

Occupational Diseases of the

1. Blood.
2. Circulatory system.
3. Respiratory system.
4. Nervous system.
5. Digestive system.
6. Muscular system.
7. Cutaneous system.
8. Urinary system.
9. Special sense organs.

COMPRESSED-AIR ILLNESS

FREDERICK L. KEAYS
Cornell University Medical College.

This paper is based largely upon a report, made by the writer in 1909[1], of 3692 cases of compressed-air illness which resulted at the Pennsylvania East River Tunnels during the time that he was medical director. It will present a brief general description of the subject of compressed-air illness, special attention being paid to its cause and to its prevention.

Triger,[2] a French engineer, who designed the first practical caisson in 1839, mentioned the occurrence of pains in the extremities of workmen employed. In 1868, Le Roy de Méricourt[3] published the first medical report of illness among sponge-divers. Since Triger's report many contributions have been made to the subject of compressed-air illness. A full review of the literature of the subject may be found in *Caisson Sickness* by Leonard Hill, a book published this year.

ETIOLOGY—CAUSES

Various theories have been advanced to explain the symptoms occurring among compressed-air workers. The earliest theory to receive general recognition was that advocated by Pol and Wattelle[4] in 1854, the so-called mechanical-congestion theory. In 1878 Paul Bert[5] proposed the theory, supporting it by logical reasoning and by experiments, which is now universally accepted. It is

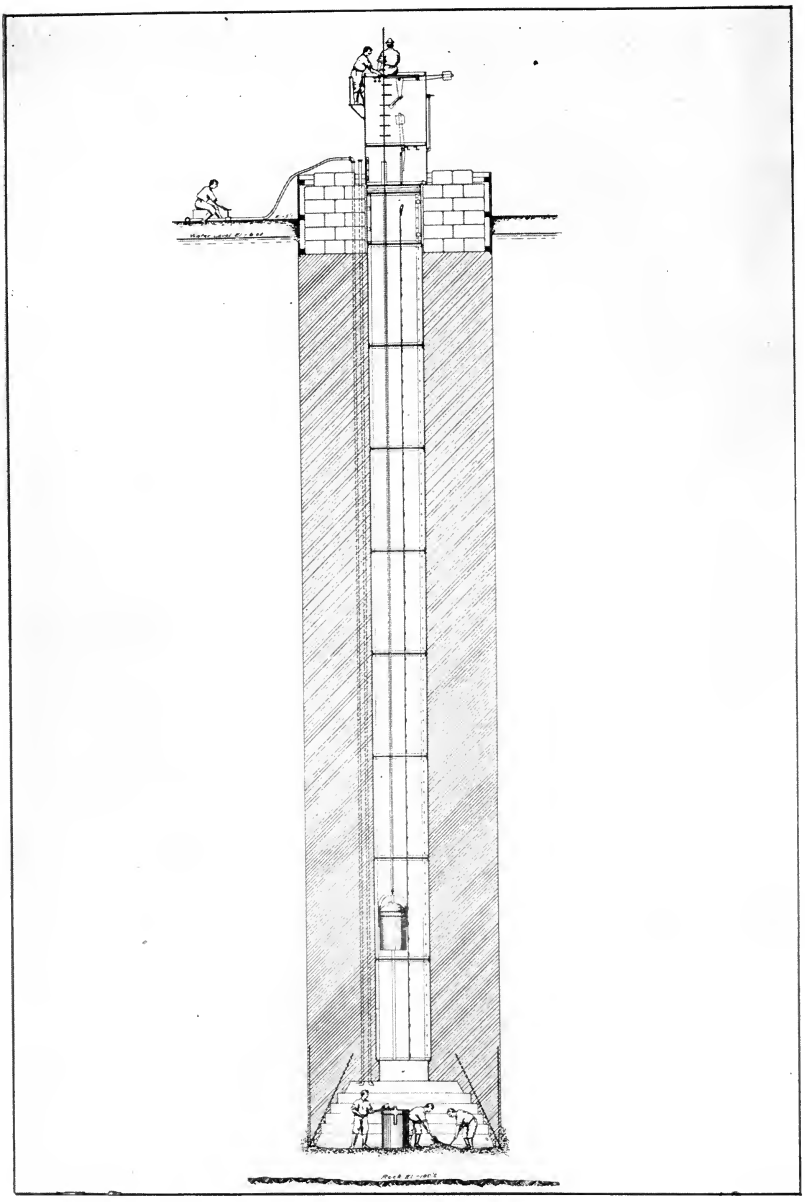
[1] Keays, "Compressed-Air Illness, With a Report of 3692 Cases," *Researches from the Department of Medicine, Publications of Cornell University Medical College,* Vol. II, pp. 1-55.

[2] Triger, "Compte rendus," *Acad. des Sciences,* 1841, tome XIII, p. 884

[3] De Méricourt, *Bull. de l'Académie de Méd.,* 1868, XXXIII. *Ann. d'Hygiene Publ. et de Méd. Légale,* 1869, second series, XXXI.

[4] Pol and Wattelle, "Memoire sur les Effets de la Compression de l'Air." *Annal. d'Hyg. Publique et de Méd. Légale.* Paris, 1854.

[5] Bert, *La Pression Barométrique.* Paris, 1878.



CROSS SECTION OF CAISSON IN FULL OPERATION

Workers ("Sand Hogs") At Bottom of Caisson Work Under Atmospheric Pressure Sufficient to Prevent Water From Flowing In As Sand is Shovelled Up

Too Rapid Decompression, as in Going Suddenly out into the Normal Atmosphere, Causes Compressed-Air Illness

a surprising fact that Bert's explanation was practically disregarded for several years, while the mechanical-congestion theory continued to be accepted, especially by the early American writers.

Briefly stated, Bert's theory is as follows: The blood of a man or of an animal, when in compressed air, takes into solution an increased quantity of oxygen and nitrogen from the air, the quantity of the gases absorbed being in direct proportion to the increase of pressure. The gases taken up by the blood are gradually distributed to the fluids of the various tissues. With rapid decompression the nitrogen gas bubbles off in the blood. These bubbles act as emboli, block up the capillaries in one or another part of the body and, by cutting off the blood supply or by direct mechanical violence, cause the symptoms of compressed-air illness. Symptoms of illness may be prevented by making decompression slow enough to allow the absorbed nitrogen to escape from the lungs. Further experimentation by Von Schrötter,[6] Hill and his associates,[7] and others, have confirmed his theory. Post-mortem findings, moreover, in many fatal cases of compressed-air illness, both in men and in animals, give conclusive proof that this theory is correct.

From this theory, as well as from practical experience, the chief etiological factors have been deduced as follows: (1) In general, the higher the pressure, the greater the chances of illness; (2) the longer the time of pressure, the greater the chances of illness; and (3) the more rapid the decompression, the greater the chances of illness.

Let us now consider these three factors in brief detail.

1. *The degree of pressure.*—Practical experience has shown that cases of compressed-air illness seldom happen at pressures up to fifteen pounds per square inch above normal.[8] Fatal cases seldom result from pressures below thirty pounds. The lowest pressure from which death has been reported is twenty-one pounds, and there seems to be some doubt as to the authenticity of this report. Among

[6] Heller, Mager and von Schrötter, *Die Luftdruckerkrankungen,* Vienna, 1900.

[7] Hill and Macleod, "Caisson Disease and Diver's Palsy," *Journal of Hygiene,* 1903, p. 401; Hill and Greenwood, *Proceedings Royal Society,* B. Vol. 77, p. 442, 1906; Vol. 79, p. 21 and p. 284, 1907.

[8] The figures in regard to pressure given in this paper all refer to the number of pounds per square inch above normal atmospheric pressure, which is a little less than 15 pounds.

twenty fatal cases of compressed-air illness resulting at the Pennsylvania East River Tunnels, only two were caused by pressures below thirty pounds, one at twenty-eight pounds, the other at twenty-nine pounds. The following table, taken at random from the records of the Pennsylvania East River Tunnels, illustrates the influence of only slight additions of pressure upon the percentage of cases of illness, when pressures in the neighborhood of thirty pounds were being used.

TUNNEL A. MANHATTAN SITE.

Month	Number of Man-shifts	Length of Shifts	Average Pressure Above Normal	No. Cases of Comp.-Air Illness	Per Cent
Jan. '07	3751	8 hours	28.5 lbs.	7	.18+
Feb. '07	4141	6 hours (2-3 hr. periods)	31 lbs.	25	.60+
Mar. '07	4902	"	31.5 lbs.	33	.67+
Apr. '07	4018	"	32 lbs.	39	.97+

It may be stated that, with other conditions the same, the number of cases of illness will depend directly upon the degree of pressure.

2. *The time under pressure.*—When pressures of one atmosphere or more are being used, the time spent under pressure is an important etiological factor. It is obvious that if less time is spent in compressed air than is necessary for complete saturation of the body fluids, the chances of symptoms developing upon decompression will be less than if that time is equalled or exceeded. The exact time in which complete body saturation takes place has never been determined. No doubt it varies in different individuals. It is certainly hastened by work and exercise. Some parts of the body saturate quickly and others slowly. Fat especially saturates slowly, both on account of its poor blood supply and because it has the property of absorbing about six times as much nitrogen as the other body fluids. Haldane and Boycott[9] estimated that half saturation of the body occurs in about twenty-five minutes, and almost full saturation in about ninety minutes.

[9] Boycott, Damant and Haldane, "The Prevention of Compressed-Air Illness," *Journal of Hygiene,* Vol. VIII, No. 3, June, 1908.

In the Pennsylvania East River Tunnels, when pressures of 30 lbs. and more were being used, all new men, before being allowed to work, were given a preliminary test at the prevailing tunnel pressure which lasted 90 minutes, decompression being at the rate of two pounds per minute. In 2719 preliminary tests only three cases of compressed-air illness were encountered. Two of these were mild cases of pain, and the third was a case of paralysis of the lower extremities. After the preliminary test, those who took it satisfactorily were allowed to work 90 minutes when six-hour shifts were in progress. In 2000 men who worked for 90 minutes in pressures averaging 32 lbs., seven cases of compressed-air illness resulted, all being mild cases. The small number of cases in the former group would indicate that complete saturation had not taken place in 90 minutes. The influence of work in hastening absorption would account for the increased number of cases in the latter group.

The following table, made up from the records of the Pennsylvania East River Tunnels, throws some practical light upon the question of the time of nearly complete body saturation and of the effect of work, and also indicates the effect of fatigue, as shown by a comparison of the number of cases following the first and the second three-hour periods of six-hour daily shifts:

Average Pressure (estimated)	Time under Pressure	Number of Men	Cases of Comp.-Air Illness		Remarks
			No.	Per cent.	
31 lbs.	1½ hours	2719 Preliminary test, not working	3	0.18+	2 cases ordinary pain. 1 case paralysis legs.
32 lbs.	1½ hours	2000 (estimated) Working	7	0.35+	All ordinary cases (pain, vertigo, etc.)
29 lbs.	2 hours	6000 (estimated) Working	13	0.21+	1 case pain and prostration, not severe. Rest, ordinary cases.
33 lbs.	3 hours 1st half 6-hr. shift	43,680 (est.) Working B.& D. Tunnels, Manhattan	152	0.35+	4 fatal. 2 pain and prostration. 3 partial paralysis. Rest, ordinary cases.
33 lbs.	3 hours 2nd half 6-hr. shift	"	317	0.72+	2 fatal. 1 pain and prostration. 1 partial paralysis. Rest, ordinary cases.

The decreased percentage of cases of illness from two hours work, as compared with that from one and one-half hours work, is accounted for by the lower pressures in the former case. At the same pressure, other factors being equal, two hours work would probably be followed by more cases than one and one-half hours work. In comparing results from three-hour shifts with those from one and one-half and two-hour shifts, it should be noted that in the former case the percentages were based chiefly upon old workmen; but in the latter the percentages were based entirely upon new men.

3. *The time of decompression.*—All authorities agree that the rate of decompression is a most important factor in determining the number of cases of compressed-air illness, as well as in determining their severity. During decompression the absorbed gases are liberated from the body fluids and blood in the form of bubbles, and are excreted through the lungs. The rapidity with which these gases are set free, and the size of the gas bubbles, depend directly upon the rate at which the pressure is removed. Consequently rapid decompression increases the chances of illness and slow decompression diminishes them. It is not known how long it takes for complete desaturation; like saturation it probably differs in individuals. The practical problem is to find, if possible, a safe rate of decompression. From practical experience it has been learned that with pressures up to 15 or 20 lbs. rapid decompression seldom gives rise to any symptoms, and probably never, even after long exposures of six to eight hours, to those due to large quantities of free gas in the circulatory system. An explanation of this, which appears logical, is that at these pressures not enough gases can be absorbed to embarrass the circulation even when suddenly liberated. That rapid decompression from pressures of four or more atmospheres is more dangerous than slow decompression has been repeatedly demonstrated in animal experimentation.

Bert concluded, from experiments with animals, that all trouble could be avoided by allowing thirty minutes for decompression from pressures between two and three atmospheres and sixty minutes for decompression from pressures between three and four atmospheres. Von Schrötter considers an allowance of twenty minutes per atmosphere safe; and Hill and his associates found twenty minutes per atmosphere safe for a large number of animals exposed to satur-

ation. Haldane,[10] on the other hand, advocates the interrupted or stage method of decompression. Starting from the fact that rapid decompression from 19 lbs. to normal atmospheric pressure is comparatively safe, he argued that it would be correspondingly safe to decompress rapidly from four to two atmospheres, or from six to three atmospheres, and he found this true in a series of experiments with animals. He proposes the following rate of decompression for caisson and tunnel work:

Working Pressure in Pounds per Square Inch	Number of Minutes for each Pound of Decompression after the First Rapid Stage.		
	After first 3 hours' exposure	After second or third 3 hours' exposure following an interval for a meal.	After 6 hours or more of continuous exposure
18–20	2	3	5
21–24	3	5	7
25–29	5	7	8
30–34	6	7	9
35–39	7	8	9
40–45	7	8	9

His first rapid stage of decompression reduces the pressure in about three minutes to a point equal to one-half the actual pressure. To illustrate, if the working pressure is 40 lbs., the actual pressure equals 55 lbs. One-half of 55 or 27.5 equals the actual pressure, or 12.5 lbs. equals the gage pressure. Applying this table to decompression from 40 lbs., one would reduce the pressure in about three minutes to 12.5 lbs. and then allow 87.5 minutes for decompression after the first three hours' exposure.

Haldane presents strong theoretical reasons in proof of the advantages of the stage method of decompression. In his own experiments with goats, however, the beneficial results of stage decompression, as compared with the uniform decompression of equal time, are less apparent than the theory would lead one to expect. Hill and Greenwood[11] tested the effects of uniform and stage decompression on pigs without showing any decided advantage for the latter method. Hill says: "The conclusion to be drawn, then, from experiments on animals is that there is evidence in favor of stage decompression after

[10] Haldane, "The Hygiene of Work in Compressed Air," *Journal of the Society of Arts.* Vol. XVI, p. 214. Jan. 1908.

[11] Hill, *Caisson Sickness,* Longmans, N. Y., 1912.

short exposures, but no decisive evidence of its superiority after long exposures. The theory is a captivating one, but experiment has not brought that conclusive support which was to be expected." In this statement by short exposures is meant periods of one hundred and twenty minutes or less.

Bornstein compared the effects of stage and uniform methods at the Elbe Tunnel Works, Hamburg, (two atmospheres), with the following results:

Days	Workers	Cases of Illness
20 stage	526	15
16 uniform	528	17
18 stage	529	12
16 uniform	529	14
14 stage	536	12

The percentage on the basis of man-shifts for the stage method is 0.15; and for the uniform method 0.19. These results show only a slight advantage for stage decompression, but they are not conclusive.

It would seem, then, that in the case of men working long periods in compressed air in pressures above 20 lbs., the question of the time taken for decompression is of more importance than the question of the method of decompression. Hill claims that exercise and the breathing of oxygen, both of which aid in the elimination of nitrogen gas, during decompression will safely permit of the reduction by at least one-half of the times of decompression advocated by Haldane.

In the Pennsylvania East River Tunnels, during a period of five hundred and fifty-seven days, with about one thousand men a day working in compressed air at pressures varying from 15 lbs. to 36 lbs., and a decompression period at the rate of one minute for each two pounds of pressure, there were reported to the medical department 3692 cases of compressed-air illness with twenty deaths. About ten thousand different men in all worked during this time. On the basis of the number of men working, the percentage of illness was 36.92 and the percentage of fatal cases 0.2. On the basis of man-shifts, estimating one thousand men a day for five hundred and fifty-seven days, or 557,000 man-shifts, the percentage of illness was 0.66 and the percentage of death 0.0035. The substitution of the

rate of decompression now required by the New York State law for tunnel work, of three pounds every two minutes up to 36 lbs. and of one pound per minute for pressure above 36 lbs., would no doubt have reduced the number of cases of illness, as well as the number of serious and fatal cases, but it seems highly improbable that it would have prevented all illness and death.

In considering the etiology of compressed-air illness it must be remembered that, beside the questions of pressure, time of compression, and rate of decompression, there are many other factors to be reckoned with, which might be called predisposing causes. Briefly stated these are as follows:

Age.—Boys, on account of underdevelopment, and men past forty are generally acknowledged to be bad subjects for compressed-air work.

Build.—Fat individuals are bad risks in compressed-air work and should be avoided.

Organic disease.—Persons with organic disease should not be subjected to work in compressed air because, even if they are not more susceptible to compressed-air illness, they are certainly less able than those with normal organs to stand the effects of such illness.

Alcoholism.—Alcoholics are bad risks for the same reason that those with organic disease are bad risks.

Newness to work.—"Green" men are more likely to have symptoms of compressed-air illness than old workmen.

Fatigue.—This appears to play a decided part in the causation of compressed-air illness.

Ventilation.—C O_2 within reasonable limits probably has no effect. Poisonous gases, such as C O and H_2S, may play a part in etiology.

The personal element.—This is a factor which I believe plays a large part in the causation of compressed-air illness. I have used this term for want of something more definite. Just what conditions may exist to make certain individuals susceptible to compressed-air illness or to cause those who have apparently been immune suddenly to develop symptoms, sometimes serious, I cannot say. It has seemed to me probable that certain individuals may lack the ability to excrete the gases from the blood at the physiological rate during decompression and that such a condition may arise at any time in men who have been free from it. In my experience I have found that certain men, who from careful examination appeared especially fit subjects,

fell easy victims to the effects of compressed air. In the work on the Pennsylvania East River Tunnels several old workmen had fatal illnesses while working under apparently the same conditions under which they had worked safely for months.

Symptoms

The time is too short to allow of a detailed report in this paper of the symptoms of compressed-air illness. They are various in form and depend first upon the amount of gas set free in the blood, and second upon what organs are affected by the gas emboli. In many cases, as when soft tissues or unimportant organs are involved, gas emboli will give no symptoms. A small gas bubble causes pain when present in some unyielding tissue, such as nerve sheath or periosteum; it causes vertigo when in the semicircular canal; paralysis when in a motor area of the spinal cord; and sudden death when in a vital center of the medulla, or possibly in the coronary artery. Large accumulations of gas in the blood stream cause general pains and prostration, and in extreme cases collapse, coma, and sudden death.

In my study of 3692 cases I made the following classification, giving the number and percentage of cases falling under each group, as follows:

	No.	Per cent
A.—*Cases showing pain in various parts of the body, "bends"*	3278	88.78+
Cases with pain also having local manifestations	9	.26+
B.—*Cases showing pain and prostration*	47	1.26+
C.—*Cases showing symptoms referable to the central nervous system:*		
1. Brain (hemiplegia)	4	.11+
2. Spinal cord:		
(a) Sensory disturbance	36	
(b) Motor disturbances	34	
(c) Sensory and motor disturbance	10	
Total (Spinal cord)	80	2.16+
D.—*Cases showing vertigo, "staggers"*	197	5.33+
E.—*Cases showing dyspnoea and sense of constriction of the chest, "chokes"*	60	1.62

F.—*Cases showing partial or complete unconsciousness with collapse*	17	.46+
Grand total	3692	99.98+

Fatal Cases
- Group B..... 6
- Group C..... 5
- Group F..... 9

20 or .54+ per cent.

Pathology

The results of autopsy in fatal cases have fallen largely under two classes: first, those which died after long illnesses and showed lesions of the spinal cord, such as disseminated and transverse myelitis and hemorrhage, with consequent complications, such as pneumonia, cystitis, pyonephritis, bed sores, etc.; and second, those which died soon after decompression, many of which showed the presence in greater or less degree of free gas in the circulatory system. Von Schrötter, in an analysis of one hundred and thirty-seven fatal cases reported between the years 1854 and 1897, found twenty reported autopsies showing lesions of the spinal cord and their complications, and eighteen reported autopsies in rapidly fatal cases of which eleven showed the presence of free gas in the circulatory system. In the twenty fatal cases reported by me, five fell within the first group, and of these two came to autopsy and showed lesions of the cord and complications; fourteen fell within the second group and of these, in twelve autopsies reported, eight showed the presence of free gas in greater or less degree in the circulatory system. In cases of sudden death, when no discoverable lesions have been found, it seems fair to suppose that death has been due to the involvement of vital centers by emboli too small to be detected. In several of our fatal cases no sign of organic disease could be found.

Treatment

Recompression is the most efficient means of treatment. This was recommended by Pol and Wattelle in 1854; Bert demonstrated its value in animal experimentation about 1871; and Mr. E. W. Moir made the first practical use of the medical lock at the old Hudson

River Tunnel. He there proved its efficiency, thus making it a necessary equipment in caisson and tunnel work.

The medical air-lock, as used on the Pennsylvania East River Tunnels, consisted of an air-tight steel cylinder about six feet in diameter and twelve feet in length, closed at one end. At the other end was an entrance by means of an air-tight door which opened inwards. The cylinder was divided into two compartments by means of a transverse partition, which had a door opening toward the inner compartment. Compressed-air pipes and outlet valves supplied both chambers, so that the pressure could be raised or lowered from either chamber. This arrangement enabled the physician or attendant to enter or leave the chamber in which the patient was being treated without disturbing the pressure of that chamber. Valves were also placed outside the lock so that the pressure could be regulated from without. The inner chamber was fitted with two bunks, one on either side, upon which patients could lie, and with electric lights, telephone, clock, pressure gage, thermometer, and electric heater. A means of ventilating the inner chamber was also supplied. Heavy glass windows were placed on a line in both doors so that one could watch from outside the patient, pressure gage, and thermometer.

Recompression should be instituted as soon as possible after the appearance of symptoms, the pressure being raised quickly to the working pressure. Relief of symptoms, when afforded, usually occurs before this point is reached. Soon after reaching full tunnel pressure decompression should be begun at a rate not less than one pound per minute, and in severe cases much more slowly. At the Pennsylvania East River Tunnels we thought our results were best when decompression was made rather quickly down to 10 or 15 lbs., and then continued very slowly. During decompression the patient, if able to do so, should move about and exercise the affected part. In severe cases massage and passive movements should be administered by an attendant, and in unconscious cases artificial respiration should also be performed. If symptoms return after one recompression, a second recompression should be made. We sometimes had to recompress three or four times before permanent relief was obtained. In cases of simple pain, where there is a return of symptoms after recompression, relief, frequently permanent, may be obtained by the use of counter-irritation with linaments, the vibrator, or the Faradic current, or by hot applications. A hot bath for the

return of pain after recompression is beneficial, but would hardly be indicated in cases where there is prostration.

The results of treatment in 3692 cases in the Pennsylvania East River Tunnels were as follows:

In 3278 cases of pain in various parts of the body about 90 per cent got relief from one or more recompressions. Recompression failed to give any relief in only about .5 per cent of the cases of this class, and in some of these the failure was undoubtedly due to improper recompression or to failure of the patient to exercise while decompressing.

In forty-seven cases of pain and prostration, thirty-eight were relieved or cured by recompression, all ultimately recovering, but six had only temporary improvement and died. The other three refused the medical lock, and recovered after illnesses of about a week.

In eighty cases with symptoms referable to the central nervous system the results were as follows:—

Four cases of hemiplegia were all cleared up permanently by recompression; of thirty-six cases of sensory disturbance, thirty-four were relieved by recompression, two refused the medical lock and were improved by medical treatment; of thirty-four cases of motor disturbance, partial or complete paralysis of the legs, twenty-three were benefited by recompression and either cleared up at once or recovered later, in eleven recompression caused no improvement and of these five ultimately died, three had permanent spastic paraplegia, and three were lost sight of; of ten cases of sensory and motor disturbance, nine were permanently relieved, and one was improved, but the final result was not learned.

In one hundred and ninety-seven cases showing vertigo, with or without vomiting, pain, prostration and dyspnoea, one hundred and eight had complete relief from recompression, eighty-two had partial relief from recompression, and seven refused the medical lock.

In sixty cases of dyspnoea and sense of constriction of the chest, all cleared up with one recompression except two which required a second recompression.

In seventeen cases of partial or complete unconsciousness and collapse eight were cured or relieved by one or more recompressions, but nine had little or no relief and died. Oxygen given to several of these severe cases during decompression afforded no appreciable benefit.

Prevention of Compressed-Air Illness

How to prevent compressed-air illness is a most important question. Modern demands in engineering require the use of compressed air. Recompression, while an efficient means of treatment in mild cases, often fails to prevent disability and death in severe ones. If high pressures are to be used, all means should be employed to prevent illness. These should consist of thorough medical examinations of workmen and especially of new candidates. In cases where "green" men must work in high pressures, 25 lbs. or over, preliminary tests should be given and, if satisfactorily passed, a short working shift should first be tried. Careful supervision of the workmen should be exercised, and occasional reexaminations made, especially after any absence from work. The men should be instructed as to the dangers of rapid decompression, should be made to move about during and after decompression, and should be warned that neglect to seek medical advice at once upon the appearance of any symptoms may result disastrously. They should also be informed of the bad effects of excesses of all kinds, of improper hygiene, and of intercurrent illness.

The following table indicates briefly what can be done by medical examination and proper supervision to eliminate the predisposing causes mentioned under the subject of etiology:

Predisposing factors	*Can be prevented*
Age (improper)	Yes
Build (fat)	Yes
Organic disease	To a large extent
Alcoholism	To a large extent
Newness to work	Partly
Fatigue	No
Ventilation (bad)	To a large extent
Personal element	No, not with our present knowledge.

The chief means of preventing illness must be found in the arrangement of shifts and decompression periods to suit the pressures. In this connection we find the old conflict between labor and capital. The workman is willing to reduce the shift but rebels at what seems to him an unnecessary time for decompression. The contractor, on the other hand, desires to offset long shifts by long decompressions.

Laws have already been passed in different countries regulating

the length of shifts and decompression periods. Such a law has been passed, however, in but one state (New York) in this country. As time goes on further legislation will no doubt be needed and this could be made much more efficient if full information in regard to all cases of compressed-air illness could be reported to the state and reviewed by some competent person or board, who should recommend the necessary changes in the laws. What is now most needed is an exhaustive study of the practical application of theories which have been well worked out. In studying the causes of compressed-air illness, one should not forget that many factors play a part, and that, since the human organism is concerned, it is not a purely physical question. The results of comparatively few experiments with animals should not be looked upon as final. In the same way, the results, under certain conditions, with a comparatively few men should not be considered conclusive. While much may be done by proper regulations to diminish cases of illness and death in compressed-air work, I believe that, when pressures of two or more atmospheres are being used, it should be classed as a dangerous occupation on account of individual conditions, not now understood, which I have called the personal element.

OCCUPATIONAL SKIN DISEASES

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With the exception of certain well-defined types, occupational dermatoses as a class have not, in this country at least, received the attention they merit. While every dermatological clinic numbers among its applicants each year many patients in whom occupation has a direct or indirect bearing on the causation of their eruption, it is difficult, owing to lack of systematic investigation, to give a definite idea as to the prevalence of skin affections in the various trades. At my own clinic at the University and Bellevue Hospital Medical College about 2 per cent of the total number of new cases for 1911 constituted occupational dermatoses. The great majority of these were of the type known as trade eczemas and, while many cases yield readily to treatment and proper preventive measures, others constitute a serious inconvenience from an economic standpoint, sometimes necessitating a complete cessation from work or a change of occupation.

Cutaneous vulnerability is more or less an individual peculiarity, for while persons are met with who are so sensitive to an irritant, physical, chemical, thermal, or actinic, that they react after a short exposure or contact by an acute dermatitis, other people remain entirely unaffected. Occasionally such individuals exhibit so high a degree of sensitiveness that, instead of acquiring an immunity, an increasing susceptibility is established. Fortunately these cases are not very common and it is more usual to see workers, though subjected to continuous injury, only after a considerable time develop lesions, either from the summation effects of the irritant or because the resistance of the skin has been gradually undermined. After such a cutaneous outbreak there is frequently a tendency to acute exacerbations at regular intervals or when the occupation is resumed. These eruptions may then persist for years.

While the skin, both anatomically and physiologically, is endowed with a relative amount of protection against the action of irri-

tant substances, by reason of its exposure it is subjected to injuries of every description and these may lay the foundation for a subsequent eruption. In addition there are other contributing factors, such as a special susceptibility, a delicate skin or one presenting some congenital anomaly, as excessive dryness or ichthyosis, impaired gastro-intestinal, hepatic or renal function, a depressed state of health, neglected hygiene of the skin, or its lowered resistance due to a preexisting eruption.

We often find the same etiologic factor operative in both allied and unrelated trades, owing to similar conditions under which the work is done; for example, where men or women are exposed to excessively dry or moist heat. Such an atmosphere leads to congestion and interference with the normal activity of the skin, which is followed by various inflammatory processes and sweat eruptions like prickly heat. These affections are met with in cooks, stokers, firemen, foundry workers, etc. A warm, moist medium, such as laundresses work in, sometimes produces a cystic condition of the sweat ducts of the middle third of the face, known as hydrocystoma. Cold, by favoring the development of chilblains, causes much suffering among people who are obliged to carry on their work outdoors or in poorly heated places. In factories where drastic measures are employed for the removal of dirt or stains, cleansing agents like chlorid of lime or benzine used on the hands, by divesting the skin of its natural secretions, supply the base for an eczema. Oil, which is used wherever machinery is installed, is the causative agent of acneiform and eczematous lesions in employees who operate or are otherwise engaged about such apparatus.

In occupations which necessitate standing, people who have a tendency to varicose veins not infrequently exhibit this condition, with a secondary eczema and ulceration. Slight traumatisms lead to erosions of the skin, which often become infected in patients who, owing to venous congestion, have slight resistance. Young women who are obliged to stand at their work sometimes develop erythema induratum or Bazin's disease, which is characterized by nodules beneath the skin that may break down and produce ulcers. Some of these forms of Bazin's disease have been proved to be tuberculous. The infection is usually of benign type and readily yields to rest in bed, improved nutrition, and a change to better hygienic surroundings.

Many occupations, without being pathological in the strict sense of the word, bring about changes in the skin which are so characteristic that Blaschko[1] has given them the name of trade stigmata. These include localized thickenings of the horny layer in shoemakers, tailors, musicians, etc.; bronzing of the skin in gardeners, farmers, and other people who follow outdoor occupations; staining of the hands in dyers, chimney-sweeps, etc.; pigmentation in workers in silver from a deposit of the latter metal and in millers from iron particles, etc.

The skin responds to the most diverse irritants, on the one hand by the production of a catarrhal inflammation, and on the other by the development of different types of eruption from the action of the same agent. Of the former we have an example in the trade eczemas and of the latter in the effects of working with tar, where eczema, acne, warty and epitheliomatous lesions may exist alone or intermingled.

The commonest type of occupational disease is an eczematoid dermatitis. In a recent article Herxheimer[2] enumerates seventy-four trades provocative of this form of disease. It may vary in grade and intensity from an erythematous and scaling dermatitis to a vesicular and bullous eruption. As the condition becomes chronic, infiltration of the skin takes place, with desquamation and fissuring. With the cutaneous defenses lowered, pus infection is frequently superadded.

The excessive use of soap and water, by extracting the fat and macerating the horny cells, reduces the resistance of the skin. These agents may then act as direct excitants or prepare the way for some other irritant, as washing powders, etc. Severe eczemas of the hands and forearms are seen in those whose occupations require them to have their hands continually in water, as in the case of washerwomen, housemaids, barkeepers, etc. In my clinic nearly one-third of the occupational diseases during the past year were seen in persons whose vocations necessitated the frequent employment of soap and water, and in some cases of the various cleansing alkalis.

[1] Blaschko, "Gewerblichen Hautkrankheiten." *Handbuch der Arbeiterkrankheiten,* Th. Weyl-Gustav Fischer, 1908.

[2] Herxheimer, "Ueber die gewerblichen Erkrankungen der Haut." *Deutsch. Med. Wochenschr.,* 1912, Nr. 1.

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OCCUPATIONAL SKIN DISEASES

1. Papilloma of Palm of the Hand of An Iron-Worker. Three Years' Duration. Lesion is due to Friction from the tools of the trade

2. Common Type of Chronic Eczema of Hands and Forearms Following Prolonged Contact with Irritants. In this case the irritant was wood-alcohol used in the preparation of varnish

In bakers a form of dermatitis of the hands and forearms is known as baker's itch. The exciting causes are the heat, the moist dough, and the saccharine solutions. A mite said to live in flour has also been incriminated. Candy-makers suffer from a similar eruption, as well as from impetiginous lesions. Confectioners, bakers, and preservers of fruit frequently show an eczema of the fingers and peri-ungual tissues from the action of fruit acids.

In a personal communication, Winfield describes a dermatitis in sugar-refiners, which involves the hands, forearms, and legs, and resembles an impetiginous scabies. It has been claimed that a mite found in raw sugar is responsible, but this lacks verification. Oliver[3] states that in sugar factories a condition known as "lymphangitis of sugar-makers" is sometimes found among the sugar-refiners and molasses stirrers. It is accompanied by a slight constitutional disturbance and a crop of boils is not an unusual sequel. According to Gaillot the lymphangitis is a *Staphylococcus pyogenes aureus* infection. This organism is said to be found, not in the freshly made molasses, but in the residue, and the temperature of the factory and the condition of the skin favor its development.

Builders and masons develop an eczematous affection of the exposed parts of the body from the irritating effects of lime and cement. In stonecutters an analogous condition is caused by the stone dust. A palmar dermatitis is also seen in brickmakers. Metal workers, whether from the constant irritation of the dust or filings, their direct cauterant action, or that of acids or turpentine used in the various processes, suffer from all grades of inflammation to intractable ulceration. Printers and machinists, from contact with chemicals and oil, often develop a chronic eczema of hands and forearms. Electroplaters are also liable to an inflammation of the hands and forearms from the use of a mixture of lime dust and olive oil in "finishing" and of sour beer in the process known as "scratch brushing."

Workers who handle the chromates in the arts and trades suffer from an eczematoid eruption, as well as from ulceration of the skin and mucous membrane, which shows little tendency to heal. Hydrofluoric acid, employed in the manufacture of glass, the bleaching of cane, the washing of manure, etc., produces sores of the nasal orifice and gums and painful blisters and ulcers of the skin.

[3] Oliver, *Diseases of Occupation.* E. P. Dutton & Co., 1908.

The irritant action of arsenic on the skin is well known. In the arts and manufactures where its compounds are employed, workers are attacked with eczema or ulcerative or gangrenous lesions, which may be present on the face, neck and extremities, but more especially the genitals. In color works ulcers of the hands are designated "arsenic pock." The sulfid of arsenic which, with lime, is used in curing fur, sets up a very severe dermatitis in furriers, not infrequently with persistent ulceration.

Chemists are prone to inflammation of the hands and sometimes of the face from handling various drugs and chemicals. Their skin often develops so marked a susceptibility that minute quantities or even fumes will call forth an outbreak. I have several times noted a similar anaphylactic condition from formalin in laboratory workers. Another familiar example of an eczema due to chemical action is that of the hands of physicians and nurses from the use of antiseptics, notably bichlorid of mercury and carbolic acid. These forms of dermatitis are very rebellious to treatment.

Among miners, smelter workers, and photographers an eruption of erythematous and pustular type is sometimes encountered from the irritant effects of mercury. Photographers are also subject to an eczema, more especially of the terminal phalanges and nails, from other reducing agents, particularly pyrogallic acid.

In hat factories eczema of the hands is said to result from the manipulation of hot water acidulated with sulfuric acid. The eczema in tobacco workers is believed to be due to the caustic solutions used in separating the tobacco leaves. Calico-printers suffer from eczema, fissures and wounds, which often become infected. The cause here is referred to the bleaching and cauterizing substances handled.

In flax and linen workers various skin affections are reported, among them a follicular eruption due to the oils and irritating materials met with in this occupation. In Belgium many of the flax workers show a peculiar abrasion and ulceration of the palmar surface of the hands. Fissures form, exfoliation takes place, and when the deeper structures are involved the condition stimulates a syphilitic lesion. An eruption resembling smallpox has also been described on the forearms, arms, and faces of workers who remove the bobbins from spinning-frames. From the pressure and friction

caused by pulling threads the people who engage in this part of the work present callosities on their index fingers.

Callosities of the palms are also met with in laborers, engine drivers, etc. Among miners they form a special dermatosis called "beat hand." Painful thickenings develop over the regions where the handle of the pick makes greatest pressure, along the bases of the fingers, over the ball of the thumb, and on the outer side of the hand. The subjacent tissue becomes inflamed, and not infrequently is further complicated by suppuration. To this condition the term "keens" is applied.

Warts sometimes form very troublesome lesions on the palms of people engaged in manual work. In some cases they are purely epidermic growths; in others, where the epidermis has been removed, the underlying tissue, as the result of irritation, becomes the seat of exuberant granulations with papillomatous formation.

Dyers and workers in anilin colors are apt to develop eczematoid and pustular eruptions on different portions of the body. The bad effects are not limited to those in this trade, but the wearers of clothing prepared with certain of the dyes may ultimately be the victims of a severe dermatitis. The black, red, and orange-yellow pigments are particularly irritating, marked inflammatory reactions having been caused by socks, gloves, underwear, and shoes so colored. I have also seen unusually severe forms of eczematoid dermatitis in barbers who had employed proprietary anilin hair dyes on their patrons. It is not an uncommon experience in dermatological practice to be consulted for a dermatitis of the face, neck, and ears which had followed the application of various of these hair dyes. In susceptible subjects the use of hair tonics may produce similar trouble. Another dermatological condition met with in anilin workers is a hyperidrosis of the palms due to washing the hands with chlorid of lime for the removal of dyes. According to Blaschko it may be so intense as to amount to a flux. The affection is also seen in chlorid of lime and soda workers.

The manufacture of chlorid of calcium and chlorid of sodium and potassium by electrolysis is sometimes attended by an erythematous and edematous inflammation of the face of the workmen resembling erysipelas. This is attributed to the hypochlorite of soda that is formed. With the subsidence of the acute process an acneiform eruption is left behind, the so-called chloracne. This is the com-

monest cutaneous malady met with in this occupation and is characterized by the early development of blackheads on the face, trunk, and extremities, followed by a grayish discoloration of the face. With inflammation and suppuration of the follicular glands, nodules, pustules, boils, and disfiguring scars are a not uncommon sequel.

Tar and paraffin workers develop a similar eruption which may last several months and then change to the so-called "tar itch." This is accompanied by hyperkeratosis and increased activity of the sebaceous glands, forming plaques and crusts, with the further development of multiple warts, one or more of which degenerate into malignant growths. The disease affects chiefly the hands, forearms, and scrotum. It progresses slowly and in many instances no recurrence takes place after removal of the epithelioma. Oliver cites the case of a man aged 58 who had worked among coal-oil and tar products for thirty years. He presented numerous indurated patches, some of which had ulcerated, as well as multiple black warts and scars, the remains of old ulcers. On the other hand, his son, 27 years old, following the same employment, developed a malignant growth of the forearm which necessitated amputation. Metastases of the axillary and cervical lymph nodes took place and the patient succumbed to secondary carcinosis.

Cancer in chimney-sweeps has been reported chiefly from England. The soot produces a chronic irritation of the skin, and when retained in such regions as the folds of the scrotum causes warty growths which become epitheliomatous. In some instances the hands, arms, and thighs have been involved. With the advent of machinery for cleaning chimneys the incidence of scrotal cancer has been markedly reduced. It is reported that gardeners who employ soot for the protection of plants from slugs show in a like manner the effects of this irritant in the development of malignant growths of the hands.

Gardeners and florists frequently suffer from some form of inflammation of the hands and arms occasioned by contact with certain plants. It is estimated that some sixty or seventy plants possess this irritant action and the power to induce a dermatitis. The more familiar ones are poison-ivy, poison-sumac, primrose, chrysanthemum, and eucalyptus, the eruption varying from a simple erythema to marked swelling, with the formation of vesicles and bullæ. Not only are the exposed parts involved, but the affection may be carried by the hands or clothing to other portions of the body. It is probable that

the active principle in the majority of these plants, as in the case of *Rhus toxicodendron,* is an essential oil. Lacquer which is obtained from a tree belonging to the genus Rhus produces a dermatitis either by direct contact or through the fumes from evaporation.[4] The symptoms appear in a few hours, and consist of fever and edema of the skin of the face, limbs, and generative organs, nasal and conjunctival catarrh, and a papular eruption of the legs and forearms.

The resinous dust of certain hardwoods, like teak, ebony, satinwood, rosewood and others, will occasionally set up a dermatitis in carpenters and joiners. In teak the exciting agent is believed to be an essential oil derived from the central part of the tree and present in the dust. The symptoms are sometimes very severe, the eruption becoming generalized and accompanied by vomiting. It may last for several months and is quite apt to recur on resumption of work.

The so-called "polisher's itch" of the forearms and hands, met with in furniture polishers, is attributed to the methyl or impure alcohols present in varnishes and polishes. Impure benzine and turpentine used for cleansing purposes likewise provoke an eczema of the hands.

In individuals who follow an outdoor occupation the uncovered portions of the skin sometimes undergo peculiar degenerative changes. Under the name of "sailor's skin" Unna has described an affection which he observed chiefly in seafaring men. A diffuse cyanotic redness not unlike chilblain develops at first on the ears, on adjacent parts of the cheeks and temples, on the backs of the hands, and on the fingers. The skin then becomes mottled, pigmented, rough, and hard, and in places papillomatous. These warts may last for years and slowly undergo a malignant change. A similar condition is met with on the face, neck, and hands of people who follow agricultural pursuits. The cause is sought in the actinic rays. The effect of light on the skin is illustrated in X-ray workers, in whom, unless protected, the hands become the seat of a mild erythemato-squamous eruption, more or less persisent, which is succeeded by pigmentation, telangiectases, and atrophic wrinkling. This condition may remain unchanged, or keratoses may be added, which develop into epitheliomata.

Drivers and coachmen exposed to the rigors of the weather are

[4] Castellani and Chambers, "Lacquer Poisoning." *Manual of Tropical Medicine,* 1910, p. 118.

often the subjects of the severer forms of rosacea. The use of alcohol, however, to which many of these people are addicted, cannot be wholly ignored as a contributing etiological factor.

Certain callings, notably those dealing with dead or live animals or their products, favor the development of infectious diseases. Owing to the prevalence of pyogenic organisms, local pus infections, as boils, carbuncles, impetigo contagiosa, or cellulitis are not infrequently met with in butchers, slaughter-house men, and other individuals who handle dead animal matter. A generalized bullous dermatitis, with severe constitutional symptoms and a high mortality, has also been observed. The starting point is usually an infected wound. Several years ago Bowen[5] pointed to a possible relationship between these cases of so-called "acute infectious pemphigus" and foot and mouth disease of cattle, as he had observed such instances during an epizootic of the latter disease in New England. Foot and mouth disease takes place by inoculation of the skin or mucous membrane in butchers, dairymen, stableboys, and drivers. Herxheimer records having seen a case in a horsedealer.

The parasitic diseases which are more definitely identified with particular avocations are tuberculosis, anthrax, glanders and actinomycosis. Inoculation tuberculosis occurs in its simplest form as verruca necrogenica or anatomical tubercle. It is encountered chiefly among medical students, physicians, hospital ward attendants, and butchers as a localized papillomatous formation usually about the knuckles or other parts of the hand or forearm.

Anthrax is very uncommon in this country, but it is very prevalent in animals, especially cattle and sheep, in certain parts of Europe and Asia. In man the disease occurs as the result of direct infection from such animals or their products, via the skin, the intestines, or more rarely the lungs. It is met with in the wool-sorting, wool-combing and spinning industries, in horse-hair and brush factories, in stevedores, wharf-laborers, carters, farmers, shepherds, butchers, meat inspectors, and cattle salesmen. The internal form is known as "wool-sorter's disease." Of the external, which is also the more usual, there are two varieties, the malignant pustule and malignant anthrax edema, the latter of which is the more fatal of the two.

[5] Bowen, "Acute Infectious Pemphigus in a Butcher During an Epizootic of Foot and Mouth Disease with a Consideration of the Possible Relationship of the Two Affections." *Journ. Cutaneous Diseases,* 1904, vol. xxii, p. 253.

Glanders, usually contracted from horses, is seen almost exclusively in hostlers or those who have to do with these animals. It is rare in this country. The bacillus may gain entrance through the mucous membrane of the eye, nose, mouth, or respiratory tract, or the site of inoculation may be a lesion of the skin. Clinically the disease is divided into glanders and farcy, according to whether the lesions of the mucous membrane or skin predominate. Both types present an acute and a chronic form.

Actinomycosis is endemic in cattle and more rarely affects horses, hogs, and other animals. In man the disease is seen in those who come in contact with such animals or who handle fodder or grain, as farmers, coachmen, dairymen, millers, etc. Infection in man takes place through a carious tooth or a lesion in the mouth, and less often through the skin. The ray fungus is believed to flourish on corn, hay, and cereal grains, as the latter has frequently formed the nucleus of an actinomycotic lesion.

Erysipeloid, an infection of the skin caused by poisoning from meats, fish, poultry, cheese, and similar animal products, is seen chiefly in butchers, fishmongers, poultry dealers, cooks and scullions. From Gilchrist's[6] observations, crab bites and injury by crabs are a frequent cause. The disease is believed by Rosenbach to be due to a micro-organism of the order Cladothrix. It is characterized by one or more areas of slowly spreading inflammation, clearing up at the part originally affected and progressing slowly to new areas, the advancing border being festooned or scalloped. Burning, pricking, or itching sensations accompany the affection, which involves chiefly the fingers and hands.

Among the minor infections may be mentioned ringworm transmitted from horses, dogs, and other domestic animals to men and boys employed about stables or engaged in the care of such diseased animals. Ringworm of equine origin is characterized by the formation of irregular and projecting nodular lesions studded with pustules involving the beard region, neck, wrist, or hands.

In certain grain regions infested by a mite, *Pediculoides ventricosus,* an intensely itching urticarioid eruption is epidemic among the farmers and laborers who handle sacks of wheat, barley, and other

[6] Gilchrist, "Erysipeloid, with a Record of 329 Cases, of Which 323 were Caused by Crab Bites or Lesions Produced by Crabs." *Journ. Cutaneous Diseases,* Vol. xxii, 1904, p. 507.

grains or straw harboring this parasite. Small epidemics have also appeared at different times from the use of mattresses made from straw on which the organism had made its habitat. To Dr. Jay F. Schamberg[7] belongs the credit of priority in describing the affection in this country.

In conclusion, while many of the industrial dermatoses lead to little inconvenience, some forms of dermatitis may become so severe that they absolutely prevent a man from carrying on his occupation. In certain susceptible individuals the action of the irritant is not confined to the parts exposed, but may spread over the entire body. Where patients develop such an idiosyncrasy they should be guarded against these forms of dermatitis becoming permanent, and should be advised as to the best means of prevention. Such measures cannot be discussed at length in a paper of this scope, as they must necessarily fit individual cases. If the nature of the work permits, the wearing of masks and gloves to protect the exposed parts, as practised by Chinese lacquerers, is advisable, but obviously this is not feasible in all forms of occupation. The use of soap and water is to be recommended in some trades in order to remove the noxious substances; while in those instances where they prove the irritants they are positively injurious and should be sparingly used. In any case, after washing, the hands should always be very carefully dried and, if practicable, covered with a protective ointment, or a salve or cold cream should be thoroughly rubbed into the skin at night. People whose vocations bring them in contact with live or dead animals or their products should be instructed as to the mode of inoculation of infections from these sources, and all wounds or breaks in the continuity of the skin should be sealed with collodion, plaster, or some other protective dressing.

[7] Schamberg, "Grain Itch (Acaro-Dermatitis Urticarioides): A Study of a New Disease in this Country." *Journ. Cutaneous Diseases,* 1910, Vol. xxviii, p. 67.

OCCUPATIONAL NERVOUS AND MENTAL DISEASES

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The nervous and mental diseases which may be called occupational are brought about by one or more of three agencies: (1) The occupation itself may be such as directly to cause damage to the nervous tissues, as when a cigarmaker gets a cramp or neuritis, or a painter or worker in a lead factory gets an arm paralysis. This is a direct occupational disease. (2) The occupation may be such that exposure and the mode of work or life almost necessarily involve risks, temptations, or accidents which lead to disease. Thus cab-drivers suffer from occupational alcoholism, and soldiers in time of war and millworkers on very long hours suffer from occupational insanities of various kinds. These may be called indirect occupational neuroses or psychoses. (3) Nervous diseases may develop when work is carried on under such depressing conditions of meager wages or insanitary and unwholesome factory and home life that ill health necessarily follows. These may be called industrial neuroses and psychoses. With this broad view of the nervous diseases of occupations one can see that the subject is not easily exhausted.

Direct Occupational Nervous Diseases

The direct occupational nervous diseases are quite numerous. They take the form of paralysis, atrophy, inflammation of the nerves of the arm or leg, neuralgia, paresthesia, and dysesthesia (disagreeable numbness, prickling, tingling, etc.). In most skilled workers, and in all kinds of workers who do one skilful act over and over again for long periods of time, we have the occupational cramps; writer's, telegrapher's, musician's, pianist's, etc. Though about ninety per cent of these troubles affect the arms and hands, the legs are also affected, and we have paralysis and pains in tailors, gardeners, and potato diggers, besides the more serious paralysis of the legs in caisson disease. The occupations which involve long

periods of standing also cause various foot-pains, due usually more strictly to mechanical disturbances of the ligaments, bones, and muscles than to nerves. Policemen, soldiers, and letter-carriers have podalgia, sciatica, and other painful troubles. The nerves of the head are least often involved, but miners suffer from nystagmus, boilermakers and rivetters from deafness, and workers with strong arc-lights from paralysis of the accommodation or light reflex muscles.

The general facts about these troubles were set forth by Dr. Starr and myself in papers read before the Academy of Medicine and published in the *Medical Record* of February 3, 1912. It was shown that among occupational nervous diseases, the most serious and frequent were those due to lead poisoning; and it has been shown by Dr. Alice Hamilton that lead is used and lead poisoning may occur in one hundred and eleven different trades. Arsenic, which is used in the furrier's trade and twenty-six others, is much less often a cause of nervous disease, but it has been in the past an important source of danger in the manufacture of wall-papers and in beer making. Mercury and brass occasionally cause symptoms of nervousness, tremors, and asthenic and anemic states.

The number of occupations in which, by reason of mistake or overuse of the hands and arms, we find neuritis, neuralgia, and cramps, is very large. I gave a list of twenty such occupations in my previous paper. In a Paris thesis, 1901, under the title *Occupational Neuritis,* Dr. Helene R. Baraks gives a list of one hundred and nineteen different occupations in which inflammation of some nerves, mainly those of the arm and shoulder, was due to the work in which the persons were employed. She reports over two hundred cases illustrating the different conditions. Bruising and pressure on the parts and overwork are the immediate causes. In New York the occupations which contribute most often to these troubles are those of tailors, cutters, ironers, pressers, laundry workers, musicians (pianists and violinists), porters and other carriers of heavy weights, stenographers, telegraphers, and bookkeepers.

The occupational nervous troubles, aside from those due to the caisson disease and to lead, and aside from the cramps, are not very serious. They are curable as a rule in a few months. In rare cases, however, they pass on to serious and progressive organic disease

(atrophy or sclerosis). These troubles are caused partly by carelessness and uncleanliness and perhaps more often by prolonged and excessive work.

If I were to single out any one point for special attention and action, I should advise that short pamphlets be written to be circulated among ironers, pressers, tailors and especially cutters, cigarmakers, masons, and boilermakers, whose work involves heavy, regular manual movements; and also among workers in compressed air and those who have to handle arc-lights, cautioning them against the dangers and showing how they may be avoided. The dangers of lead, mercury, arsenic, phosphorus and caisson work have already been fully explained. The remedies have only to be applied.

Summing up, one may say that the principal occupational nervous diseases are:

1.	Toxic:	Lead palsies, neuralgias, psychoses. Arsenical palsies. Mercurial tremors, etc.
2.	Mechanical:	Paralyses, neuritic and atrophic. Atrophies. Parasthesias. Neuralgias. Spasmodic disorders. Caisson paraplegia (the "bends").
3.	Environmental:	Exhaustion (auto-toxaemia). (Neurasthenia, psychasthenia, insanity).

Mental Disturbances Due to Occupations

The occupational psychoses, or mental disturbances due to occupations, furnish practically an unexplored field and perhaps not a fruitful one. That is to say, occupation is essentially a healthful thing, much more so than recreation or rest; and I would urge that the aim of the social and industrial reformer be not to lessen occupation, but to make it easier and more agreeable, or at least more interesting. There is nothing so mentally healthful as work.

There are, consequently, very few occupations which directly, by

reason of the kind of work, cause insanity. Nevertheless, there is a lead insanity, an alcoholic insanity, and an insanity caused by sulfid of carbon and by sulfureted hydrogen; also perhaps a mental deterioration, especially of memory, in those exposed to CO_2. Then there are certain occupations which are in their nature exciting or one-sided in their demands on the mental life, and Dr. T. H. Kellogg enumerates soldiers (and sailors), poets, prostitutes, and politicians as being especially liable to insanity. To this list others have added the occupations of cab-driver, stoker, and bartender. Millworkers who tend machines for long hours are said by Spoulting to contribute unduly to the state hospitals for the insane.

The insanities due indirectly to occupation and industrial conditions are, moreover, very numerous and important. Forel says: "Other causes, such as the herding together of the proletariat in great cities, in bad rooms or tenements with insufficient food and unhealthy employment, undoubtedly weaken the nervous system." And Dr. Kaplan, in enumerating the causes of that devastating form of mental degeneration, dementia praecox, says:

> Most, if not all, of my patients came from the congested districts of Greater New York; they lived in tenement houses; they were deprived of light, proper sanitation, fresh air, and good food; they worked in sweatshops for means of getting their livelihood; they were in constant struggle and strife for the maintenance of their existence. Some of the married women were compelled to work in shops, in addition to their housework, in order to support the family. Seventy-two patients did housework; thirty-three were employed in shops; three had positions in stores; eight were dressmakers; two were bookkeepers; three stenographers; one a governess; one an attendant in a hospital for the insane; two clerks; one a student; four had no occupation.

Influence of General Industrial Conditions

All this, however, is in a way only incident to industrial progress and more intense social activity. The occupation of becoming highly civilized leads to increase of insanity. In the north of Italy, among the active industrial population, says Tanzi, the percentage of insanity is 25.3 per 10,000. In southern Italy it is 1.3 to 6.6 per cent. Crowd people together and there surely will be more insane. Occupations compelling life to be lived under congested conditions are thus indirectly the cause of insanity. If we wish to improve industrial conditions with a view to improving mental

health, we should discourage urban industries, especially urban factories.

This is not because of the industries or the factories, so much as it is because of the mode of living. What is the use of high wages and short hours if life away from work is unhealthful? The occupation of making shirtwaists may keep one well or drive one insane, according to the nature of the home and the kind of rest and amusements which are taken. But we should also discourage industrial isolation. Man needs social life as much as he does fresh air and good food. Men are like certain trees which do best when they are planted just so far apart; not too close, for then the roots encroach and rob each other of nourishment; and not so far apart that there is no support and protection from the sun and winds.

The active money-earning occupations of life, then, have really little in themselves to do with causing the great mass of nervous and mental disorders. It is what is done between times, what kind of rest is taken, and what kind of home life is lived. It is this which does the harm. Women have many more nervous troubles than men, but they have fewer occupations and the fewer they have the more they get nervous. It is, then, I repeat, not occupations themselves, but the industrial and domestic conditions to which working people are subjected which cause the mass of nervous and mental diseases.

Take a man or a woman and make him or her do a dexterous piece of work over and over again during long hours and under a nervous strain. Underfeed a little, shorten or disturb the sleep, and you can produce neuralgia or neuritis or a cramp within from two to three months. Take a person who has not a very stable nervous system and put him at work for long hours, at tasks of concentration or skill. Let him have no real recreation and not quite enough restful sleep and you can produce a mental trouble of at least a minor type.

Those who work on a certain tension, like mill operatives in charge of machinery, engineers, etc., and those who work always with a strain and effort to finish a certain fixed amount in a fixed time, get nervous or mental troubles unless they have periods of real recreation. Real play is needed for hard, tense work. For the ordinary worker it is not so important. Scientific manage-

ment, therefore, which speeds up the human machine, must give it longer rest and an absolute change of nervous and mental interest.

The direct occupational causes of mental diseases are, then, of small importance. The industrial causes, however, which lead to bad home conditions, bad forms of recreation and rest, bad social and moral conditions, are of immense and fundamental importance. We could lessen insanity more by razing tenement-houses than by shortening hours of labor. Occupation is mentally healthful; play may be exhausting and dangerous. Give the hard-working man knowledge and opportunity to spend his leisure well, just as seriously and just as quickly as you give him more leisure. Some legislation, but much more ordinary good sense and sanitary rules should be preached. I would say, then, in conclusion, that occupational and industrial nervous diseases call for special attention on the part of the sanitarian and of the legislator.

OCCUPATIONAL EYE DISEASES

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If we are to judge from the relative space assigned to them in our books, the importance of occupational diseases of the eyes has not been properly estimated. There are many industries which regularly cause serious organic diseases of the eyes while, in the wider sense, there are few skilled occupations in which the eyes are not used far beyond nature's intentions, with corresponding discomfort and disability. I have no intention of giving you a catalogue of the rare diseases which have been observed from time to time in connection with our modern highly specialized industries, but I do wish to call your attention to several distinct types of occupational disease and to assure you that of each variety there are numerous subvarieties.

Exposure to Injurious Substances

Trade accidents should not, of course, be classed as trade diseases, whether of the eye or of other organs. It is very difficult, however, to draw any hard and fast line between the occasional injuries which must be classed as accidents, and those which, like injuries from dust, are due to constant exposure to injurious substances and must, therefore, be assumed as conditions of the industry. To lose an eye from the impact of a popping cork is doubtless an accident, though not by any means so rare a one as you might suppose. But, in the bottling industries, accidents of this sort happen so regularly that they have to be considered as incidents of the trade and guarded against accordingly. The same may be said of the bursting of unprotected water gages and of other similar accidents which so often destroy the eyes of engineers and machinists. The daily total of more or less dangerous injuries to the eyes of workmen is something enormous.

Consider the men employed in the various grinding trades. In working over an emery wheel, for instance, there is a constant stream of small particles thrown off at great speed. The experienced man has learned to save his eyes as much as possible, but the beginner is always in trouble. When these particles are small they are removed from the eye by a fellow workman with the corner of a dirty handkerchief, the soft end of a chewed toothpick, or the point of a penknife. Every large shop has some man who is particularly expert at removing these foreign bodies, and it is only when they are too deeply embedded for the amateur operator's skill that they are referred to the physician. The writer often sees half a dozen or more cases in a single afternoon in his dispensary service, most of them showing signs of previous manipulation. Considering the chances for infection, bad results are astonishingly rare. Nevertheless, there are many cases in which infection does occur, resulting in extreme pain, loss of time, more or less permanent disability, and most infrequently in the loss of the eye itself. It must not be forgotten that every one of these foreign bodies, except the most superficial, produces a minute but permanent opacity of the cornea, which if rightly situated interferes seriously with sight. I have seen many men with numerous scars in each eye as the result of repeated injuries of this kind, and yet they seem to learn nothing, the same ones coming back time after time in spite of warning and advice. The various safeguards that have been devised do not seem to be practical, for opposition to their use seems to come from the men rather than from their employers.

Then there is the less frequent but much more serious list of injuries caused by the larger bits of metal and stone in foundries, quarries, and mines. These chips fly through the air with tremendous velocity and not infrequently pass clear through an eye. These are, of course, accidents and are therefore rather outside the limits of this paper, but they are for the most part preventable and they should be prevented.

There are many other trades each of which has its own peculiar type of injury, like the lime burn and the solder burn. Practically all the so-called dusty trades cause chronic inflammation of the eyes, which not only makes trouble in itself but predisposes to various infections. Masons and plasterers not only suffer from lime burns but commonly have chronic conjunctivitis, as do flour-mill

employees. Hop pickers suffer from an acute inflammation of the conjunctiva during the season, and farmers and other outdoor laborers who are exposed to wind and dust very often develop pterygium.

Trade Poisoning

There are also many trades in which the workmen suffer more or less permanent loss of sight through the absorption of drugs of one sort or another, and the number of these is constantly increasing as the complexity of our manufacturing processes increases. I have no intention of giving you a list of all the chemicals which are on record as having produced blindness. The list is a long one and many of them are important simply as suggesting profitable directions for future investigation. Among them are tobacco; alcohol; lead, used in so many different industries; bisulfid of carbon, used in the manufacture of rubber; nitrobenzol, used in the manufacture of explosives; and some of the anilin dyes.

The one to which I wish particularly to draw attention is methyl or wood-alcohol. Owing to its low price it has very largely displaced grain alcohol in manufacturing processes. It was never intended for internal use, but has long been consumed by the ignorant and benighted as furnishing a cheap and very potent source of intoxication. Such sprees often end in death and more often in a specific type of blindness. Since attention has been devoted to this subject, it has been found that in susceptible individuals a very small dose of wood-alcohol may produce permanent total blindness. Ten drops have produced this effect in one case. Furthermore, instances are accumulating in which the same result has followed its use as a substitute for grain alcohol in bathing and rubbing.

But the fact that compels us to class wood-alcohol blindness with the occupational diseases is the increasing number of cases in which it has followed mere inhalation of the vapor for a comparatively short period. It is used in many of the trades as a solvent of shellac, as, for instance, by painters and hat makers. Many typical cases are now on record of blindness in painters, who have used it in removing varnish in close rooms or in applying shellac to the inside of beer vats and the like.

There are probably many cases of wood-alcohol poisoning which are entirely unrecognized. Tyson reports a whole room of girls in

a pencil factory who suffered from ill-defined disturbances of vision, among other symptoms. It was finally discovered, almost by accident, that the pencils were varnished with wood-alcohol, and with suitable ventilation the trouble disappeared.

Apparently there is no valid excuse for the manufacture of wood-alcohol. Its actual cost is much greater than that of grain alcohol, and its manufacture results in the denudation of mile after mile of growing timber. To facilitate the use of grain alcohol in the arts the government permits the sale of the so-called denatured alcohol tax free; but unfortunately one of the processes of denaturing consists of adding ten per cent of wood-alcohol, which is sufficient to make even denatured alcohol dangerous to the susceptible. It is, perhaps, beyond the scope of this paper, but Holden has recently called attention to the fact that many retail druggists sell wood-alcohol over the counter under various names, not only without any indication of its poisonous nature, but with the phrase on the label "guaranteed under the food and drug act", which many people understand, not as a guarantee of purity, but of harmlessness.

We have much to learn about the subject before we can legislate intelligently. The manufacturers claim that the pure wood-alcohol is harmless, the poisonous brands being those incompletely refined, while even the latter are safe enough if sufficient ventilation is secured.

Disabilities Due to Exposure to Light

There is another long list of more or less serious disabilities which result from exposure of the eyes to artificial light, made necessary by our modern factory conditions. Electricians are dazzled and sometimes blinded by sudden exposure to the intense light caused by blow-outs and short circuits. Too intense light, like that of the arc lamp, decomposes the visual purple faster than it can be regenerated and causes a condition of retinal exhaustion. It also causes, in the effort to exclude the light, a constant extreme contraction of the pupil, which is both painful and fatiguing. This accounts for the asthenopia which is so common in many trades which, like those of gilders, metal polishers, and glass workers, compel a close attention to polished surfaces which reflect light.

The modern methods of industrial lighting have made the composition as well as the intensity of light a subject of great practical

importance. Incandescent gas and electric lights contain many of the violet and ultra-violet rays, which are not only useless for illuminating purposes, but are capable of causing effects on the eye not unlike a modified snow-blindness. The worker who is exposed to them day after day often develops annoying inflammations of the lids and conjunctiva, and also often suffers from asthenopic symptoms which vastly diminish his efficiency. Furthermore, their effect on the deeper structures of the eye is suspected of being still more serious. The refractive media of the eye absorb most, if not all, of these ultra-violet rays, so that the retina suffers little harm, but it is quite possible that the continued process of absorption may be one of the causes of cataract. It is certain that stokers, bottle makers, glass-blowers, and others who are continually exposed to very intense light and heat have an enormously increased liability to cataract. One foreign observer found that as many as 40 per cent of the bottle makers in one establishment showed evidences of cataract, though the great majority of them were under forty years of age. The left eye, which is nearest the fire, was invariably affected more than the right.

Diseases Due to Occupational Strain

There is also a very large group of diseases, organic or functional, which are due to prolonged use or excessive strain of the eyes. The eye is one of the most complicated organs in the body. Perfect single vision requires not only two good eyes but their complete coordination, which is accomplished by the joint action of fourteen separate muscles. Four of the twelve great cranial nerves are devoted exclusively to vision. When one stops to think that most people use their eyes almost constantly and that many tasks involve a continuous strain for hours at a time, one begins to understand why vision necessitates expenditures of nerve and muscle energy beyond almost any other function.

There are at least three distinct types of eye fatigue which show themselves in different trades. We have already alluded to the retinal fatigue resulting from the constant watching of polished or reflecting surfaces, resulting in the asthenopia of gilders and polishers. Next comes the muscular fatigue which we see in the trades that compel the constant use of the eyes for close, fine work. The perfectly normal eye sees things close at hand only by a process

of accommodation or focusing, which is a muscular effort and which produces a normal fatigue. It is, therefore, perfectly possible to strain healthy, normal eyes by overwork. In most of the so-called errors of refraction, hyperopia, astigmatism, and the like, distinct vision is only possible by overaccommodation, and the individual who has to accommodate too much naturally becomes tired sooner than he otherwise would. Holden, in a very interesting paper, calls attention to the fact that one of the first occupational diseases of which we have any record was the scholar's disease; his headache, his eye pains, his indigestion, and his pessimism were ascribed to his sedentary life and his brain work. Many of the ills which the scholar endured were due to overuse of his eyes and are to-day relieved by the use of suitable glasses. But the scholar no longer has any monopoly of either the symptoms or the life. To-day there are many trades in which the workman sits hour after hour chiefly engaged in watching intently—a task which eventually tires even the normal, healthy eye. And among the factory workers, badly housed, ill fed for generations, diseased, refractive errors, which are for the most part congenital, are not only practically universal, but often so great that they cannot be compensated for by any amount of strain.

Consider the garment workers, for instance. They all suffer from errors of refraction, large or small. They have less than the normal compensatory powers because their muscles are overworked and badly fed. They work long hours in close, badly ventilated, badly lighted rooms, driven to the utmost. The least muscular relaxation means indistinct vision and mistakes in their work, and for every mistake there is a regular tariff of fines and deductions. The constant strain to see distinctly results in a whole series of eye symptoms. The muscular fatigue causes headache, which most operatives seem to consider an inevitable incident of life. The eye, like the hand, has its muscle cramps from overstimulation, and its pareses from exhaustion, but, while the cramp of writers and telegraphers is regularly included in the list of occupational diseases, nothing is said of the far more common ciliary spasm or the convergence insufficiency of the eye worker. The nervous exhaustion which follows the effort to stimulate tired ocular muscles day after day is certainly one at least of the causes of lowered vitality and depression. Neurasthenia and the other

fatigue and attention neuroses are said to be practically universal among the garment workers, and no small part of it can be ascribed to eyestrain.

Miner's nystagmus has always been described as the type of occupational disease resulting from eyestrain of a definite sort. Progressive myopia is no less so. Practically unknown in infancy, it first appears occasionally in the early years of school, and becomes more and more common as the children advance from grade to grade. In the various social classes it is found to be in direct proportion to the amount of close work which they have to do. Among the German lithographers Cohn found that 45 per cent were myopic and among the typesetters 51 per cent. The same practical conclusions are true the world over. The myopic eye is a diseased eye and progressive myopia means a gradual failure of vision, constant liability to ocular inflammation, and in many cases final blindness. It is a true occupational disease which in Germany accounts for approximately ten per cent of blindness.

Conclusion

I have given a very brief resumé of certain types of disability which may affect the eyes as the result of certain occupations. Before we can possibly have wise legislation we must have far more exact knowledge of many of them. Accidents and injuries are, even to-day, passably taken care of. They are interesting to the physician, and their cause, their treatment, and their prevention are often so obvious that much progress has already been made in reducing their frequency.

The study of the trade poisonings which affect the eyes is still, however, in its infancy in this country, and is not likely to progress much till a change is made in the method of investigation. The hospital physician is in no position to study them. They come to him as isolated cases, often in patients who speak little or no English and who work at trades the details of which are unknown to him. Most of them have no pathognomonic symptoms to distinguish them from similar conditions which are not occupational. I am sceptical of the scientific value of the compulsory reporting of such cases. It will doubtless reveal occasional extreme typical cases and be worth while from an educational standpoint and from the standpoint of punishing legal infractions, but that it will add

much of scientific value to the specialist's knowledge of occupational diseases I doubt. The place to study these conditions is not in the hospital or the clinic but in the factory. What we need is an intensive study, once for all, of each of the important trades by a group of trained observers.

Personally I believe that the eye diseases due to fatigue are far more important than we commonly suppose. More people are blind from malignant myopia and retinal detachment than from all the trade poisonings. More inefficiency and more misery are caused by defective eyes than by diseased ones. There is no field in which it would be easier to enlist the enlightened self-interest of employers. Any intelligent shop management must consider the eyes of employees. There may be a place in our modern factory system for the lame and the halt, but not for the blind or the partly blind. Professor Munsterberg can tell by psychological tests whether it will be worth while to train a girl as a telephone operator. The oculist, in his turn, can not only do a good deal to convert unprofitable into profitable employees; he can pick out employee after employee whom no intelligent man could afford to hire. More than this he can form a pretty good estimate of those who are fit to-day but will be unfit to-morrow. There has been so much exaggeration on the subject of eyestrain that the medical profession has disgustedly refused its attention, and yet I know of no one factor that affects the earning capacity of the laboring classes to such an extent. I know of no medical field to-day in which the poor and the ignorant have been so entirely abandoned to the care of the incompetent and the dishonest. Here again intensive study is needed.

INDUSTRIAL POISONING

David L. Edsall
Harvard Medical School.

There has been a great deal said in the past few years about the general problem of industrial hygiene, but until very recently there has been a deplorable lack in this country of precise information in regard to industrial intoxication. Even yet, in spite of the investigations made by Dr. Alice Hamilton, Dr. John B. Andrews, and others for the Labor Bureau, the Illinois Industrial Disease Commission, and the American Association for Labor Legislation, we do not have anything like the detailed information which is available in Europe. I have been able to get more information in two or three days from an official introduction in a foreign country than I can get in this country in two or three months. The only difficulty there is that the manufacturers are often afraid you are looking into trade secrets; they don't care how much you look into trade health.

Yet we know that conditions in this country are certainly as bad as conditions abroad. There used to be claims that, owing to our great national ingenuity and inventiveness, or to other causes, there was not so much industrial disease here and that, therefore, we did not need the rigid legal control which they exercise in other countries. But the recent investigations of phosphorus and lead and mercury poisoning show that we are dealing with conditions that need attention here just as much as abroad. Dr. Thompson has mentioned his experience in New York with regard to lead poisoning, and I have had some experience in Philadelphia. From my own records I could produce more cases of lead poisoning from each of two white-lead works there than from any similar works in Great Britain. I have gone over the records of some of the latter and know what they are.

The work I have done, however, has been purely individual. Official information and investigation is much better. The experience we gain from unofficial investigations is very vague and fragmentary and brings to light only a fraction of what exists. As good

evidence as I have ever had of this fact was in connection with two large plants, both of which used carbon bisulfid and lead. One manufacturer told me they had so little trouble they did not pay any attention to it at all. The other plant, carrying on the same processes, told me with the greatest openness that they had considerable trouble with carbon bisulfid and lead in spite of great precautions. It is essential to get precise and definite studies on the subject from an official standpoint.

. Such studies are particularly necessary, I believe, by reason of the fact that a great many processes in this country differ from the processes abroad. It is an interesting fact that Great Britain has had a different problem to deal with from that in Germany. As we know, Germany's vast commercial importance is the development of the last half century or less and it has been possible, therefore, to put into effect there almost any law affecting the health of employees without greatly disturbing the manufacturer. In England many persons carried on trades in very old localities and old shops and if they had enacted drastic laws immediately they would have destroyed their industries. They had different conditions. We are only making a beginning at regulation and are far behind both Germany and Great Britain. But we must know our own conditions, and not go too much on observations in other countries, if we are going to deal justly with our industries. From the United States Bureau of Labor and other such sources we must get the information we need. No one need feel, because we have acquired some valuable knowledge of conditions in the last two or three years, that we have approached a fraction of what is really important.

In getting this information and in drawing up regulations based upon it, the first thing we need is uniformity,—uniformity between investigating agencies and between states. If we cannot have uniformity in the first place we will have trouble in classification. Moreover, it is extremely important in legislation, for any regulation of these things in one state, when there is no regulation in surrounding states, may do such harm to industries that they will move to another state or new industries will not develop there. Uniformity is the first step in regulation.

The reporting of industrial diseases, and the reporting of a larger number than now required in the eight states that demand such reports, furnishes the most important source of information. The

importance of this is at once recognizable by anyone who knows even vaguely the effect of the reporting of infectious diseases, though very few except those interested know the profound effect of the reporting of industrial diseases. As a striking example of this, I was talking with Dr. Legge, the head of the medical inspection of factories in England, in regard to their regulations concerning industrial intoxication. His long experience under the British reporting law has made him familiar with almost all the plants in Great Britain, and particularly with all the different operations of these plants. He told me, if I wanted to see a curious difficulty which they had not been able to remedy, to go to a certain pottery. Then he pointed out various plants elsewhere that exhibited simple or more complex means of overcoming particular dangers. This detailed information gave him precise knowledge as to where any company needed to be corrected and where they did not need to be corrected. There is other important information that cannot be gained in any way except by the reporting of diseases. In particular it gives a definite idea as to whether or not regulations are doing the right amount of good.

Another fact that the reporting of industrial diseases opens out is the occasional necessity for rather drastic special regulations in regard to matters of this kind, such as the French laws concerning the use of lead paint. In England they have had little improvement, owing to their regulations, in lead poisoning among painters. It may be that they will be forced into drastic prohibitory laws like those in France.

The medical inspection of working people exposed to conditions of this kind will unquestionably, I am sure, lead to improvements of conditions equal to those from reporting diseases. The manufacturers abroad that I have talked with about this, and I talked with a number in England, were actually enthusiastic then, though they opposed it at first. Some told me that, although required by law to have an inspection once a month, they had voluntarily introduced it once a week because it had the value of detecting any trouble at once. The manufacturer has been rather condemned this morning by one or two speakers. My experience has been that very frequently he is quite as willing to cooperate as anyone else. Manufacturers may be divided into three classes: those who are educated as to the value of these matters, those who are willing to be educated, and

those who are uneducated and unwilling. But many of them are willing to do what they can if the matter is once made clear to them.

An essential thing that, it seems to me, needs to be done in overcoming the conditions we are facing is to establish some definite standards. That is true of anything relating to industrial conditions or anything else. You cannot make improvements unless you know the standard of improvements. Most of our laws in regard to industrial hygiene throw the whole burden on the medical inspector. If he is an honest and capable man he may do it well. If he tends to be a grafter, he can use his position for that purpose. If he is uninstructed he does nothing. In England the regulations in regard to potteries fill a large pamphlet, going precisely into every detail. This is fair to the manufacturer, because he knows what he must do; but it holds him up if he does not do it. Standards should be given in every instance when possible, so that the manufacturer may come up to the standard and not just vaguely try to do the right thing. Even then inspectors should be trained.

Another important thing is that the regulations shall not be dependent upon the occasional meeting of a state legislature, that there shall be some provision similar to that in the English law, which practically gives the Secretary of State power to modify these regulations as may seem to him wise if he submits the changes to the action of Parliament as soon as possible; but in the meantime he can protect working people from changes in processes, or other things that might be dangerous, and not wait for indefinite periods.

There is only one thing more I should like to say, and that is that I think we have been and still are altogether too prone to consider occupational poisoning of various kinds merely as showing certain picturesque results. We tend to look on colic, palsy, and encephalopathy, for example, as being all of the important effects of lead poisoning, but the main effects of lead poisoning are other things; much more ill health is caused by the general effects on the health, the arteries, the kidneys, and digestion. I think we have no more right to speak of lead colic and such things as the main effects of lead poisoning than we have to speak of drowsiness as the main effect of the morphine habit. Any statistics that we can get only show a minor fraction of the results of these intoxications. They undoubtedly cause many times the bad results that appear from these definite, discoverable consequences.

COOPERATION IN PROMOTING INDUSTRIAL HYGIENE

HENRY R. SEAGER
President, American Association for Labor Legislation.

Nothing could better illustrate the advantages of cooperation in our efforts to promote industrial hygiene than the papers that have been presented at this Conference, or indeed than this Conference itself. The greatest present need in this field in the United States is undoubtedly fuller knowledge. We need to know more accurately what are the occupational diseases to which American wage-earners are exposed. We need to know the conditions which give rise to these diseases in the occupations in which they are found. Finally, we need to know the easiest and most effective means of changing conditions so that these diseases may be prevented. The fact that this is only the *Second* National Conference on Industrial Diseases is evidence of the tardy attention we are giving to occupational diseases in this country. For some time to come careful, intensive studies, like that described by Mr. Hoffman, must precede the introduction of remedial measures.[1]

If fuller knowledge is what we most need, the group to which we must look for light is obviously that of the trained physicians who have taken to heart the old adage that an ounce of prevention is worth a pound of cure, and who are deliberately turning aside from the work of curing the sick to the more important, if less appreciated, work of searching out the causes of sickness and devising measures that will narrow the field over which these causes operate. But in connection with occupational diseases physicians require, perhaps more than in any other department of preventive medicine, the cooperation of other groups. This is because occupational diseases must be studied not merely in the symptoms of

[1] The results of one such study have been published in a monograph by Mrs. Lindon Bates on *Mercury Poisoning in the Industries of New York City and Vicinity,* by the Women's Welfare Department of the National Civic Federation. Copies may be secured by application to the American Association for Labor Legislation, Metropolitan Tower, New York City.

their victims, but in direct connection with the occupations that give rise to them. It is not enough that employees who have contracted occupational diseases submit themselves to examination and treatment; other employees in the same trades who have not yet contracted the diseases must be examined, and all must be induced to furnish full information, not only in regard to the places and conditions under which they work, but also in regard to their homes and habits of life. It is not enough for employers to send employees who require treatment to company physicians; they must also grant free access to their plants and permit periodical physical examinations to be made of all their employees, both well and ill. Finally, to bring physicians, employees, and employers together in a united effort to lessen the ravages of occupational diseases, the zeal and enthusiasm of social workers are required. As in the case of tuberculosis, itself to some extent an occupational disease, so for occupational diseases generally, the road to reform lies through a vigorous campaign of public education. Social workers must be counted upon to organize this campaign and to press it on to a successful issue.

A comparison of conditions in the United States with conditions in Germany and in the United Kingdom indicates how far we are behind those countries from the point of view of public appreciation of the importance of industrial hygiene. In introducing the system of obligatory illness insurance for wage-earners in 1883 and requiring employers to contribute one-third of the necessary premiums, Germany made industrial hygiene thenceforth a matter of supreme concern to her industrial classes. Preventing occupational diseases was changed from the interest of a few unusually humane or unusually far-sighted employers to a pursuit in which the most mercenary and penny-wise were almost equally zealous. Reducing the number of employees to fall ill and the number of days of illness for those who could not be kept well, now meant reducing sick-insurance premiums and thus adding directly to the year's profits. Whatever may be thought of incidental effects of the compulsory insurance system, there can be no doubt that the wonderful progress that Germany has made in the last thirty years in the field of preventive medicine has been largely due to this bold policy of the Iron Chancellor.

The United Kingdom, in adding in 1906 to industrial accidents

certain specified industrial diseases as grounds on which wage-earners suffering a loss of earning power might demand compensation from their employers, went even further than Germany. Under this plan the employer had to pay, not merely one-third of the premiums out of which indemnities should go to wage-earners, but the whole indemnity prescribed by the law. The list of occupational diseases has been steadily expanded since the law was first passed, until now more than a score are included; and as regards these diseases, it will readily be believed, the British employer has become the eager coworker with the sanitarian in trying to lessen in every possible way the risk to which his employees are exposed. The National Illness and Unemployment Insurance Law, which comes into operation next month, gives the British employer an interest equal to that of his German colleague in reducing all forms of illness. It is no doubt unfair, as well as unkind, to British physicians to ascribe their opposition to certain features of this law to a fear that it will put them out of business; but it is certain that in England, as in Germany, the new policy will give a tremendous impetus to preventive medicine.

In the United States illness insurance, even through sick-benefit societies, is as yet little developed. Even without it, it is probably true that on strict financial grounds it is worth while for the American employer to give greater attention than is customary to keeping his employees well and strong; but for employers in our big cities, with large reserve forces of labor to draw on, the proposition is debatable. It is, therefore, essential that social workers cooperate with physicians in trying to induce employers, on grounds of humanity, or self-interest, or both, to do their indispensable part in furthering the cause of industrial hygiene. Social workers must also rouse employees to an appreciation of the risks they run in unhealthful occupations and induce them, not only to demand safer conditions, but to give the attention to personal hygiene that is now so commonly lacking.

In preference to elaborating further on the subject in general terms, I prefer to illustrate the need of cooperation in promoting industrial hygiene by describing some of the work in which the American Association for Labor Legislation has been concerned since its organization six years ago. Its founders early recognized that industrial hygiene was one of our great national needs. How

to impress this view on a busy and indifferent public was the problem. It happened that the European sections of the Association had recently been giving much attention to the prohibition of the use of poisonous phosphorus in the manufacture of matches, and that European governments had even made treaties for their mutual protection on this subject. Poisonous phosphorus thus seemed a promising industrial poison with which to begin our campaign.

When Dr. Andrews, the secretary of the Association, began his investigation of the match industry for the federal Bureau of Labor, phosphorus necrosis, "phossy-jaw", was a disease of which it is safe to say few laymen in the United States outside of match factories had ever heard, and which few physicians had ever had occasion to diagnose. His first task was to satisfy himself that this disease was one of the necessary by-products of the manufacture of poisonous matches in the United States, as it was acknowledged to be in Europe; his second, to convince an influential body of public opinion that such a dangerous, loathsome, and unnecessary disease ought to be stamped out here by prohibitive legislation, as it had been stamped out by the other civilized nations of the world. Without the cooperation of employers, employees, and physicians, his investigation must have proved a failure. I need not now detail the steps by which it was made a success, nor the two years' campaign waged by the American Association for Labor Legislation which culminated last April in the enactment of the Hughes-Esch Law imposing a prohibitive tax on poisonous phosphorus matches manufactured in the United States after July 1, 1913. Suffice to say that but for the cooperation of the majority of the match manufacturers in agreeing not to oppose the bill, on condition that it should apply to all of them alike and that it should include the prohibition of the importation of poisonous phosphorus matches, the act probably would not have been passed. Further, but for the cooperation of physicians and hospital authorities in supplying evidence of cases of phosphorus necrosis and of the ineffectiveness of preventive measures falling short of outright prohibition, the public could not have been aroused as it was against this evil. Finally, but for the aid of match workers, one of whom went to Washington to display his cruelly disfigured face to the members of the Ways and Means Committee for the sake of his fellow workers exposed to a similar fate, those gentlemen would not have reported out the bill, which had so long been held in committee.

The issue presented by the use of poisonous phosphorus in the American match industry was simpler and more clear-cut than that found in connection with any other industrial poison. Usually preventive measures, not outright prohibition, are the remedies to be sought, and usually there is great difference of opinion as to what preventive measures are best and how they may best be made effective.

Appreciating the need of further information about occupational diseases, the Association has been responsible for the introduction and enactment by eight states in the last two years of bills requiring physicians to report certain specified industrial diseases to designated state authorities, usually the state commissioner of labor. Legislatures are only too ready to pass bills imposing duties upon physicians! It was another matter to devise machinery to insure that reports of value would be sent in and that the statistics so secured would be turned to useful account.

Partly for this purpose and partly to promote industrial hygiene in other ways, the New York Association for Labor Legislation, on the initiative of its secretary, Mr. Paul Kennaday, organized last October, in conjunction with the New York Academy of Medicine, a joint committee on industrial diseases. Dr. W. Gilman Thompson has been from the first the guiding spirit of this committee, and its frequent evening meetings at his house have already resulted in achievements which promise much for its future usefulness. It was felt by all that the first work of the committee should be to try to make the law requiring the reporting of industrial diseases more effective. Dr. Hatch, statistician of the department of labor, was asked to be a member of the committee. He gladly accepted the offer of the committee to cooperate with him in drawing up a more satisfactory form for the reporting of occupational diseases than the department had been using. A much improved reporting blank was finally agreed upon, and this blank is now not only in use in New York, but is likely to be adopted by other states which require occupational disease reports. To impress upon physicians the importance of cooperating with the state authorities in the efforts to collect adequate statistics of occupational diseases, the committee next undertook the compilation of a pamphlet on the nomenclature of occupational diseases, which is to be printed and circulated by the department of labor to all of the physicians in the state.

The services of Dr. E. E. Pratt were then secured to make a report on all the investigations of occupational diseases that had up to that time been undertaken in New York State. With this report as a guide, the committee advised the special Factory Investigating Commission of this state as to the occupational diseases most likely to repay further investigation. The other work undertaken by the commission is so broad that the attention it can devote to occupational diseases has proved to be disappointingly slight, but it has asked the cooperation of the committee in framing recommendations to the state legislature for the creation of a permanent bureau for the study of occupational diseases, and with the constantly growing interest in the subject there is strong likelihood that such a recommendation will be acted upon favorably.

Besides these more important activities, the committee has served as a clearing-house of information for numerous other groups interested from other points of view in the general subject of industrial hygiene. For example, it has met with the committee on industrial poisons of the Chemists' Club of New York City and discussed possible lines of cooperation during the coming winter. It is the purpose of this committee, so soon as the necessary funds are secured, to prosecute investigations of the numerous occupational diseases that have not thus far received adequate attention. Its members, through articles and addresses to all sorts of audiences, are constantly urging the importance of greater attention to industrial hygiene. Also through its members it hopes to induce some employers voluntarily to introduce the precautionary measures that its investigations and the investigations of others prove to be desirable. So soon as the practicability and efficacy of these measures shall have been demonstrated, the Association for Labor Legislation will seek to have their introduction made mandatory through labor laws, so that the lives and health of all employees may be protected.

Our experience in New York has convinced us that the organization of a committee of physicians, sanitarians, and interested laymen, such as I have described, is an important, if not a necessary, aid to effective work for industrial hygiene. Physicians and sanitarians must supply the expert knowledge, but for the most part they are too busy to direct the work of educating public opinion or of shaping the legislation which this knowledge proves to be necessary. This

part of the task must devolve mainly on social workers. In addition, industrial chemists, representatives of life insurance companies, and officials of the appropriate departments of the city and state governments, may be drawn in to form a group which is representative of enlightened and progressive public opinion touching this problem. Through such a group tasks can easily be accomplished that would be impossible for men working in isolation, or even for the associated members of any single profession.

We recommend the organization of similar committees in other states as an efficient means of advancing the cause which we all have at heart.

GENERAL DISCUSSION

Dr. Warren Coleman, *Bellevue Hospital, New York City:* In view of the importance of the subject of industrial diseases, may I be permitted to suggest that a petition be presented from this section to the House of Delegates of the American Medical Association requesting the appointment of a committee to cooperate with the American Association for Labor Legislation to promote the study of industrial diseases.

This motion was duly seconded and unanimously carried.

Dr. Rosalie Slaughter Morton, *New York City:* I have been especially interested in this joint session. It seems a great evidence of progress that the laity and the profession of medicine should get together to work for the public good. The work done by the Association for Labor Legislation has gone so far that I, as vice-president of the Medical Section, feel it an honor to cooperate with you.

Dr. C. F. Stokes, *Surgeon General, United States Navy, Washington, D. C.:* We have been looking after occupational diseases in the Navy, but entirely on the basis of military efficiency. There is no humanitarian factor in it. Sanitation generally has reached a satisfactory condition. But in a battleship we find grouped together a more varied set of activities than will be found elsewhere in the same space.

Respecting the eye troubles, the men who adjust arc-lights have severe troubles caused by the sudden glare. In our turrets, too, we have our gun pointer, the man who points the guns; the range is so long that he must use a telescope, and we have found that these men, who started in with normal vision, have dropped down to eight and ten below. That is something which is very important to the Navy.

Then there are the toxic gases. We find in almost all these great ships a type of gas which has caused death in many instances, happily in foreign navies. The element at work seems to be a diminution of oxygen. After two or three rounds at battle practice, the carbon dioxid runs up to forty. We have powder gas at work there which gives us a carbon monoxid poison. Men who have at the

beginning of firing a pulse rate of seventy-two, have at the end of ten minutes a pulse rate of one hundred and twenty. And in the fire rooms the heat prostrations are due largely to gas contamination, carbon monoxid. The same thing applies to submarines. We have been working at this gas problem.

I was interested in what Dr. Dana had to say. It is now known that there were some two thousand men at Port Arthur during the Russian-Japanese War who were invalided home by reason of insanity. In other words, they were not temperamentally fit for that hazardous work. We find that some men get along very well during peace times but, when it comes to battle practice, or possibly to some great hazard, they break down. They are temperamentally unfit. These are all military considerations bearing on occupational hygiene.

Dr. Mark D. Stevenson, *Akron, Ohio:* Occupational eye diseases may be caused by exposure to excessive light or heat, to poisonous gases or fumes, and by prolonged and peculiar strain.

First are diseases due to excessive light or heat, e. g., in electric welders, steel smelters, and in those who melt or anneal glass. Metal polishers and buffers, brightening surfaces which they must closely watch, often suffer with hyperesthesia of the retina. This can be relieved by proper lenses or colored glasses. Excessive heat and light are met with in iron and steel works. Men can watch a furnace until the temperature is up to 2000° F., but before it gets to 3000° colored glasses should be worn. If some of these hot furnaces are looked into without lenses it is several minutes before the eye can see ordinary objects again. Some men seem to have surprising immunity from bad results in dealing with these white-hot furnaces; others cannot endure them and must change their work. Herbert Parsons and Marcus Gunn, who visited some of the important glass works in England in 1908 to gather statistics of industrial diseases for the framing of the Workmen's Compensation Act, state that bottle workers have a characteristic form of cataract,—typically, a dense, well-defined disk of opacity in the center of the posterior cortex. Excessive heat and bright light are said to be the causes, but the Germans claim that heat is the most important cause. Weyl mentions, besides glass-blowers, fire workers, puddlers, blacksmiths, bakers, and cooks. Great care is required to avoid very strong light

flashes before the eyes, as in short circuits and electric welding. In the latter large shields are worn, in the center of which are four alternate layers of blue and red glass. Helmets and screens, with four or six layers of red and green glass, are often used. The temperature in electric welding goes as high as 7000° F., but the question of whether it is the heat or the chemical rays that act so harmfully has not been settled. If the eyes catch the light they are affected at once, but usually the effect appears some hours afterwards. The eyes feel swollen as if filled with burning sand and the pain is usually severe; the lids are swollen and there is much lacrimation.

Other diseases are due to working in certain poisonous gases, fumes, dusts, or substances, such as bisulfids of carbon, lead, etc. Dinitrobenzol is largely employed in making explosives. During the various processes of its manufacture fumes are given off which affect vision. These can be lessened by properly covering the mixtures and by the use of fans and exhaust apparatus. Respirators and glasses should be used. Bisulfid of carbon, formerly much used in vulcanizing rubber, caused impaired eyesight, but this process has been so greatly modified that it is now of little importance in causing ocular lesions. Toxic amblyopias, due to tobacco, ethyl alcohol and wood-alcohol, are too well known to require consideration. The eye affections formerly attending the manufacture of iodoform have by care been eliminated. A few cases of eye involvement have been reported in dye factories from handling the various coal-tar preparations. Arsenic and paris green from wall-paper, artificial flowers, paper hangings and paintings, have caused various visual disturbances. Painters, plumbers, electrotypers, file-cutters and many others, through handling lead, are likely to get chronic lead poisoning, causing central and peripheral affections of sight, various paralyses, retrobulbar neuritis, etc. Poisonous gases and fumes are also formed in certain lead processes, and in shoe cement, japanned or patent leather, and rubber manufacturing, where the mixtures containing naphtha are sometimes allowed to remain in uncovered containers and proper ventilation is not insisted upon.

Eye diseases may also be due to occupations requiring prolonged and peculiar use of the eyes, e. g., nystagmus in miners, which is due to their peculiar way of looking at their work. Treatment consists in changing the kind of work. After relief the miner can

return to his work if the head can be kept straight and the eyes are not often turned upward. Snell mentions several other occupations which he has thought might cause nystagmus, because the eyes were turned directly or obliquely upward.

Dr. Walter F. Dutton, *Carnegie, Pa.:* The occupational disease which results from the manufacture of vanadium is not as yet well known. There are two reduction plants in the United States, in which there are a number of employees. The products are being used more and more in the manufacture of steel, in photography, and in manufacturing plants where mordants are used. The monoxid is used in photography; the dioxid in printing calicoes, and the trioxids in the manufacture of steel. This disease will become more and more well known as the use of vanadium products increases. I should like to call your attention to an article in the *Journal of the American Medical Association* of June 3, 1911.

Mr. E. C. Curtis, *New York City:* Speaking for the men who work in compressed air, I think we need very much the cooperation of physicians and of the American Association for Labor Legislation to better our condition. Up to the present time the doctors have not attended to this industry as they should. There were 3692 cases of compressed-air illness in one small job, the East River Tunnel. I have known personally of men who have entered these air-locks without the doctor ever looking at them; there were small boys who acted as doctors and passed the men to go into the caissons. We had one case in particular where we ought to get a conviction; we went before the doctor proving that the man was sent down with an abscess on his neck, and was dead before he got half way down. That is one of the conditions under which the men I represent are compelled to suffer, and I claim there is carelessness among the doctors. We had another case only recently, where a man was put into the medical air-lock while a new invention was being tried on him. They put him into cold air. The man was frozen to death in the medical air, taken out of there and laid for three solid hours on a plank, and then brought home dead. The physicians do not seem to value human life at all. Here was a man with six children brought home dead for experimental purposes. But if the physicians are going to be sincere in this matter, and the American Association for Labor Legislation and the American Medical Association will

work together, it is going to be a great help to the men in the industry I represent.

MRS. HENSON: With regard to the point just brought out, the workmen ought to know, and they do know if they stop to think about it, that physicians are better paid by the corporations. They should take this point close to heart and get after the remedy. Until the workmen own the industries, and therefore are the employers of the physicians, they will never be certain of the best service. Lest some may not have read enough of Socialism to know what I mean, they must establish the cooperative commonwealth.

DR. ALLEN STARR, *New York City:* I wish to say a word about a matter which does not seem to have been brought out in the discussion,—the necessity for informing the individual laborer of his dangers and of the means for their avoidance. It seems to me that the American Federation of Labor can do a great work by insisting in its labor unions upon certain definite information being given to each laborer, in his own department, as to the methods of avoiding these dangers, and so preserving his health. If a painter, for example, will take an ordinary piece of newspaper and place it between his sandwich and his fingers, he will not get the lead from his fingers into his mouth. Yet in a large clinic in New York last year I questioned thirty individuals suffering from lead poisoning in regard to whether any instructions had been given them, by their employers through notices posted in the factories, or in their labor unions, as to methods of avoiding lead poisoning, and found that they had never heard even of a simple device of that kind.

Many of these cases of disease, too, are the result of carelessness. I have had some experience with the caisson disease, which the gentleman from New York has alluded to. One of the most competent engineers in the employ of the Pennsylvania Railroad Company insisted on disregarding the precautions he should have known and was careless enough to come out from a tunnel without spending enough time in the various compartments. I should like to know if these men are not instructed about the necessity of remaining in the compartments a certain length of time, and whether their injuries have not resulted from carelessness.

I should also like to make one other point in defense of the manu-

facturer. I have a large acquaintance with important manufacturers in New York State, but I have yet to find one, of a reasonable degree of intelligence, who is not as much interested, from his standpoint, as the laborer is from his. I will cite one company in Jersey City which put up a factory in which incidentally there is a large amount of dust discharged into the air. This company spent $40,000, under the direction of an incompetent engineer or architect, for a system of ventilation by which the dust was taken up to the top of the room, passing on its way the mouths of the operatives. One intelligent operative came to the head of the firm, a personal friend of mine, and said: "That is a defect; if you would put your exhaust apparatus in the side of the floor, gravitation would take the dust down and we would not breathe it in." That gentleman had the good sense and the philanthropic instinct developed, and he changed the whole system and spent $20,000 more in installing a new apparatus.

I believe there is great hope along these lines of disseminating information,—first, information to the employer as to what is the necessary thing for him to do, and secondly information to the employee as to personal methods of protection. And that, it seems to me, devolves more upon the Association for Labor Legislation than it does upon us physicians.

Dr. Geier, *Cincinnati:* I wish to disagree with the last speaker when he states that you must approach the employer from the humanitarian standpoint. I have had some experience with employers in Cincinnati in the tuberculosis problem. You don't need to use the cry of humanity at all. They prefer to have you come in with a business proposition. It is perfectly possible to go to them and say: "You are doing this and that and the other thing and you are losing this and that, so many hours loss and so much inefficiency; put in this device for sanitation and ventilation and you will make from one to twenty per cent in the increased efficiency of your employees." That is the thing that is bound to appeal to the business man. As a trimming on the side we may speak of the humanitarian work; but we must approach the business man with a business proposition.

In Cincinnati there is a factory which is ready to pay $2500 to $3000 a year to a physician to come in and advise them and examine

their operatives, etc. I have been asked to find such a man. As a matter of fact I do not know one man in Cincinnati, who is not earning $5,000, $6,000, or $10,000, who has the proper sociological view to fill that position.

Dr. Charles E. Brest, *Waterford, N. Y.:* For some twelve years I pointed my practice to preventive medicine. It naturally brought me into the shops and into contact with employers, and I barked up the humanitarian tree for four or five years. I looked up statistics in regard to the mortality among employees in certain rooms where the air was the same air as when the walls of the building were put up, and presented them to the employers. But up to the good times of a few years ago, when it was difficult to get trained employees, they derided me, and there is nothing more difficult to stand than ridicule. At that time, however, I demonstrated that it is an expensive proposition to develop skilled employees and then lose them absolutely, and that it is good policy to care for them. Employers close down for a week every year to fix up the machinery; they never think of doing that for the employee. But when I put it as a business proposition the employers were willing to see the point, and they came to me, not only in cotton mills, but in laundries. I thoroughly agree with the gentleman from Cincinnati. If you present the proposition to any manufacturer who is trying to make good with his work he will cooperate with you.

Professor Henry R. Seager, *President, American Association for Labor Legislation, New York City:* Some one has said that the first work of science is classification. From that point of view it would be impossible to exaggerate the importance of Dr. Thompson's paper. The other papers give point to the suggestions which he has made, since they deal, most of them, with specific occupational diseases. We are especially glad to have evidence from the men who must know what the occupational hazards really are.

As a business proposition to employers, as a line of least resistance, I am afraid, when we consider the employer in a large city and his mass of unskilled labor, that those of us who are conscientious would not have the face to go before an employer and tell him that it would be profitable to look after the health of this man who is taken ill and turned off, for some one else can be taken on in his

place without much expense and with little trouble. But by all means let us, wherever possible, approach the problem from the point of view of business. I do not regard that as optimistic. It seems to me those who approach the problem from the humanitarian point of view are the more optimistic.

DR. A. M. HARVEY, *Chicago:* As one of the chief duties of the physician is to prevent disease and preserve health, it is indeed gratifying to attend a joint meeting of physicians and members of an Association which is interested in proposing legislation for the protection of the health of workers. We need a great deal more knowledge of the subject of occupational diseases before proper laws can be proposed and enacted. Nothing should be done hastily, for we undoubtedly have too many laws now on our books that are not enforced.

I believe that one of the chief things that can be done to prevent occupational disease is to limit the age at which children may go to work, and another is to limit the hours of work so that the worker may recover from the fatigue incident to his labor. My experience with workers during the past sixteen years has shown me that many diseases may be prevented by proper elimination of dusts and noxious gases and by proper ventilation and lighting of workshops.

As all speakers have said, a great deal can be done by cooperation, but I think we have left out one class of organizations with which we should cooperate, the manufacturers' associations of the various states. In Illinois we have an influential manufacturers' association, and I think it would be very easy to induce it and other similar associations to take up the work as outlined in this symposium. I know that many of the larger manufacturers in Illinois have maintained health departments for years, have a great deal of data for which you have been asking, and would do a good deal toward preventing disease. Many of our manufacturers have taken an interest both from the humanitarian standpoint and from the economic standpoint, because they know it is hard to get skilled workers and that it is cheaper to prevent than to cure.

MRS. FLORENCE KELLEY, *National Consumers' League, New York City:* As a layman I have listened to the papers of the morning with the very greatest interest and I should not venture to criticize the

medical statements. But Dr. Edsall ventured into my own field when he suggested that we should not be hasty or drastic in drafting bills for the protection of working people lest the manufacturer move from one state to another. Manufacturers do not move from one state to another to escape legislation for the protection of working people. Our legislation is very halting and faulty compared with that of Europe, and its enactment is always accompanied by threats of removal from manufacturers.

Since May, 1889, I have been looking for the manufacturer who actually moves to escape such laws. For four years I was head of the state factory inspection of Illinois. The Illinois Glass Company of Alton made the most ominous threats in order to escape the enforcement of the child labor law enacted in 1893. We found two hundred and ninety-six violations of that law and made it clear that children under fourteen must be dismissed, that children under sixteen must not work at night, and that all children must have the certificates required by law. The threat has been renewed by that company at every amendment to the statute. But the company has not moved. It has stayed where it was and has multiplied its staff and plant by three in the intervening years.

I did once appear to have come upon a case in which a textile mill had moved from Massachusetts to Rhode Island in consequence of an amendment which made the laws for the protection of women and children more drastic. When I hunted it up I found that the company was desirous of establishing new and entirely modern, up-to-date plants simultaneously in one of the southern states and in New England. It received from the village to which it went in Rhode Island the gift of right to the land and valuable concessions in regard to water power. Its removal has been used as an argument against improved legislation in Rhode Island and Massachusetts; but no one, not even the manufacturers themselves, could clearly disentangle the influence of a slightly increased rigidity in the laws regulating the employment of children from the gift of land and lasting concessions of water power.

We want uniformity, but we don't want to let uniformity become such a bugaboo that we are afraid to do anything for fear a state may cease to be uniformly bad with the other states. I challenge anyone here, and I have been challenging anyone from whom I had any hopes of enlightenment for twenty-three years, to produce an

authentic case of the removal of a manufacturer from one state to another because of the protection of the workingman.

Mr. Miles M. Dawson, *New York City:* I feel as if I were taking the position Scipio Africanus is said to have taken before the Roman Senate, "Carthage must be destroyed", when I arise to speak concerning the intimate and necessary relations between the various branches of the work we are unfolding and starting in the United States. We can never accomplish what we wish in the matter of industrial hygiene and the prevention of industrial diseases until we have throughout the United States a system of compulsory sick insurance. The statement made by the lady who spoke of the necessity for the workman being interested in the employment of the physician, whatever we may think about her general conclusion, is justifiable. The physicians have not given the caisson sickness proper attention. We need in the United States something which will take care of our people and we shall not be able to do it effectively until they are obliged to have sickness insurance.

Professor Samuel McCune Lindsay, *Columbia University, New York City:* In view of the fact that every speaker has confessed that our ignorance of occupational diseases is so great that any legislation at present would be hasty, we are likely to have hasty and ill-considered legislation. But there are some kinds of legislation we are now ready for, and it is important that, at this joint meeting of the Medical and Labor Legislation Associations, we should turn our thought to the kind of legislation for which we are ready.

I shall pass over the sort of legislation that has resulted so satisfactorily in the prevention of phosphorus poisoning, where our knowledge was a little further advanced than in regard to other kinds of industrial poisoning. We need authoritative information and, as has been suggested by several speakers, we are all agreed that such information can be had, in the last analysis, only with the cooperation and support of the state. In other words, we must secure legislation in several states that will set to work the machinery we need to get that information. I have just returned from Washington, where I have been in connection with the work of the committee which has undertaken to urge the passage of a bill providing

for an impartial national commission to inquire into all the relations between employers and employees. Such a commission, I take it, would properly bring within the scope of its inquiry the subject we are discussing. That measure should have the support of all here present.

Reference was made by one of the speakers to the disagreeable feature of reporting cases of industrial disease, the burden on the physician. I think the gentleman suggested that he had a little doubt about the advantage of these laws. But it ought to be pointed out that the use of such a schedule as that of the bureau of labor of New York will have a good effect. It will call the physician's attention to the industrial side of the health problem and will have a value in his work which will make the burden not without its reward. At any rate, it seems to me that this is a type of legislation for which we are ready, and that the American Association for Labor Legislation is justified in pushing its campaign to have reporting laws passed in all the great states.

II

INVESTIGATION OF INDUSTRIAL DISEASES

Presiding Officer: HENRY R. SEAGER
President, American Association for Labor Legislation
NEW YORK CITY

INTENSIVE INVESTIGATIONS IN INDUSTRIAL HYGIENE

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Industrial hygiene is gradually assuming the position of an applied science in its relation to government and the public at large. The nation-wide agitation for effective workmen's compensation legislation and the establishment of state insurance for this purpose in Washington, Ohio, and Massachusetts, emphasizes the necessity for trustworthy information, statistical or otherwise, with regard to the whole question of health and safety in American industry. It is not going too far to say that most of the published information on the subject of industrial hygiene and industrial accidents is of very limited practical value, and much of it is decidedly misleading.

There have been very few intensive studies of the actual conditions under which American industry is carried on at the present time. In the memorial to the President on the appointment of a national commission for the investigation of industrial diseases, practically all the conclusive evidence was derived from foreign sources or intensive and more or less conclusive investigations made in foreign countries. It is most encouraging, however, that within recent years the necessity for such investigations should have been recognized, and mention only requires to be made of what has been done in this respect by the states of Massachusetts, New York, Illinois, etc. The honor belongs to the state of Illinois for having been the first to appoint a special commission to investigate and report upon the subject of industrial diseases, and the report of that commission constitutes a valuable contribution to the literature of industrial hygiene. The publications of the Massachusetts State Board of Health, and of the New York State Department of Labor require also to be mentioned as helpful indications of the direction which in years to come investigations of this kind are bound to take to an increasing extent. The monograph by Dr. Andrews on phosphorus poisoning and the reports by Dr. Hamilton on lead poisoning

are epoch-making documents which separate precisely the field of guesswork opinion from the field of impartially ascertained facts.

The principles which underlie all investigations of this kind are not as yet fully defined. It may be said at the outset, however, that every industry should be inquired into with reference to the health and safety of persons employed therein, but with a due regard to the essential conditions under which such industries can be economically, profitably, and efficiently carried on. It is important in all investigations of this kind that the investigator first make himself thoroughly familiar with the technique of the industry or trade about to be investigated, since whatsoever conclusions may be arrived at, they must be more or less conditioned by the elements of the industry itself. A clear understanding of the technical details of any given industry or trade often requires much patient study and research, but without such an understanding of the methods by which a particular industry or trade is carried on most of the conclusions as to health and safety must be more or less wanting in the essential requirements of absolute accuracy and impartiality.

It is unfortunate for research in the field of American industrial hygiene that most of the textbooks descriptive of industrial or manufacturing processes should be by foreign authorities, just as is the case with regard to textbooks on occupational diseases and the prevention of accidents. Some notable exceptions are the standard works of reference on metallurgical processes and industrial chemistry. The treatise on *Industrial Organic Chemistry* by Sadtler, and the *Outlines of Industrial Chemistry* by Thorp, are indispensable to research work in a large number of industries chiefly or partly inclusive of chemical processes of manufacture. The earlier *Dictionary of Arts, Manufactures, and Mines* by Ure, in three volumes, and the still earlier *Cyclopedia of Useful Arts* by Tomlinson, and *Chambers' Information for the People,* published in 1847, are useful for the purpose of illustrating the methods and processes of manufacture in the past. Some of the descriptive accounts of industrial processes published by the Census Office from time to time since 1880 are of considerable practical value in investigations of this kind, but it is much to be regretted that there should not be a popular treatise on the technology of trades and industries giving, at least in brief outline, an intelligent account of modern methods of manufacture, with particular reference to the safety and health of the employees, and including the smaller, but frequently more important trades.

As illustrations of the textbooks useful for the purpose of obtaining a sound preliminary understanding of the essential factors in industry, I may refer to the treatise on *The Manufacture and Properties of Iron and Steel,* by Campbell; *Modern Copper Smelting,* by Peters; *The Textbook of Ore-Dressing,* by Richards; and *Lead and Zinc Pigments,* by Holley. For many of the industries excellent monographs have been published by corporations which, by their illustrations alone, render substantial aid to the students of industrial processes in their relation to health and life. I may refer to a short treatise on *The Destructive Distillation of Bituminous Coal,* with reference to the United-Otto system of by-product coke ovens, which practically constitutes a guide to that rather intricate process which has made the utilization of valuable waste products a commercial possibility. The federal and state geological surveys publish reports which frequently contain interesting observations and suggestive illustrations, but I can only refer to the report of the geological survey of the State of New York on the lime and cement industries of that state, and to the report on the manufacture of roofing tiles, published by the geological survey of Ohio.

Next to a sound technical foundation it is of some importance that the historical facts of any given industry be taken into account, and while the history of American manufactures has not been brought down to date, Bishop's classical work is still of value, monographs are occasionally printed by institutions of learning, and the report on manufacturing industries by the Census Office also contains much useful information. I can only refer to the excellent monograph on *The Printers,* by Professor Barnett, published by the American Economic Association, and to the historical account of the English tin miners, by Lewis, published in the series of Harvard Economic Studies.

The most useful sources of information with regard to industrial processes are the technical trade journals, which for practically all of the industries extend over a considerable period of time. These publications, to an increasing extent, take into account the economic and social conditions of labor, and with special regard to wages, hours of labor, etc. The reports and bulletins of the federal Bureau of Labor and of the state departments of labor, moreover, make an immense amount of more or less trustworthy information conveniently available. Such reports of the federal Bureau of Labor as

have recently been published on the steel industry, and the series of reports on the condition of women and children, emphasize important elements of inquiry which require to be taken into account.

It is the disregard of this necessity for preliminary education which usually accounts for failure to secure the best possible results. Intensive industrial investigations are a burden upon industry and they should be made only by those qualified for the task, and by men or women thoroughly trained *in advance* with regard to all the facts and conditions which they can ascertain from existing sources of information. Industry does not exist for the purpose of providing material for the writing of books or descriptive monographs, but solely for purposes of production at a rate of profit consistent with safe and economical management. The large majority of manufacturers throughout the United States are deserving of unstinted praise for the manner in which their establishments are conducted and made to conform to legal and moral requirements with regard to the safety, health, and comfort of employees. The difficulty is not so much in what is obvious as in what is *not* obvious. Immense progress has been made and the tendency practically everywhere is decidedly toward betterment consistent with the conditions under which industry can be profitably carried on.

The problem is one of ignorance rather than of neglect. Most of the factors which condition health and safety in industry are as yet very imperfectly understood, at least in the United States. It is true that within the last quarter of a century immense progress has been made in Germany, but largely because of the requirements of compulsory accident insurance institutions established to replace an antiquated system of employers' liability law. We have not as yet developed in this country the function of the safety engineer, who has attained to such high professional standing throughout the German Empire because of the practical utility of his services. Manufacturers or employers of labor generally are not blamable for their reluctance to install expensive safety devices, or ventilating devices, or other methods or means by which health, safety, and comfort can be improved, unless the evidence is conclusive that the investment will be productive of the desired results. The function of the ventilating engineer in his relation to industrial requirements is practically new, and almost the same may be said of the function of the illuminating engineer. All of these questions require to be

taken into account by the critic of industrial conditions in so far as they have relation to the safety, health, and comfort of the employees.

A manufacturing plant is private property and admission thereto obtained by visitors or investigators is a matter of courtesy on the part of the corporation or firm. All manufacturing establishments are subject to the visitorial powers and duties of state labor bureaus, or state factory inspection bureaus, and to a certain extent of state boards of health. The inspectors of these respective governmental departments are free to make their investigations without let or hindrance, and their conclusions, so far as practicable, should be made public as a matter of record. Until, however, the status of the factory inspector, or the health inspector, is raised to the dignity and far-reaching responsibility inherent in the position, it is self-evident that radical conclusions must be accepted with caution, and exceedingly favorable reports must be looked upon with more or less distrust. It is not going too far to say that most of the published reports of factory inspectors in this country are of very limited practical utility for research work in the field of industrial hygiene; while, in marked contrast, the annual reports of the chief factory inspectors of England, Germany, Austria, France, Switzerland, Belgium, etc., are models of their kind and trustworthy sources of information with regard to conditions more or less detrimental to health and life in industry.

The investigator, having obtained permission, as a matter of courtesy, to visit an industrial establishment, should refrain from any conversation with the employees except by the specific permission of the employer. A labor force, under the best conditions, is easily disturbed by the visits of strangers, and most of all by men or women who are supposed to be in search of information or facts more or less detrimental to the industry investigated. There are everywhere employees with grievances, whose evidence may be given in good faith, but who cannot be relied upon in matters of fact. The investigator should be a trained observer and should take notes at the time of inspection of everything seen or heard which has any possible bearing upon the purpose of the investigation—that is, whether conditions exist which are a menace to the safety and health of the employee.

The investigator must keep in mind that employers of labor who

have given years to the operation of a particular plant, possibly representative of extremely complex methods of manufacture, are not likely to be indifferent to the desirability that the best possible conditions of work be maintained. At the same time it quite frequently happens that the most obvious need escapes attention, since the mind of the employer is preoccupied with matters of more immediate personal concern. Every manufacturer or employer of labor welcomes intelligent, concrete suggestions as to methods and means by which the conditions affecting the health and safety of his employees can be materially improved. The investigator may safely take it for granted that, broadly speaking, the manufacturer or employer is as much interested in the ascertainment of the truth regarding actual conditions as the outside public or the investigator himself. He is fully assured of the most hearty cooperation in the large majority of cases in which intensive investigations are made under proper conditions and by thoroughly qualified persons fit to go into delicate matters of this kind.

The information obtained may be considered confidential or not, according to the previous understanding with the manufacturer or employer whose particular plant has been made the subject of an inquiry. As a rule, there should be a precise agreement on this point, and if a written report is made a copy thereof should be sent to the manufacturer or employer for verification or for such comments as misstatements or errors in matters of fact may require.

It is hardly possible, on an occasion of this kind, to enumerate all of the factors which should be taken into account. It requires no discussion to prove that such problems as air conditioning in textile mills, the mechanical properties of industrial dust or the effective removal of such dust by ventilating devices, the alleged pathogenic properties of mine air, or the injurious effect of intense light in electro-metallurgical processes, all demand special and highly technical qualifications for the rendering of a judgment or opinion that may be relied upon as sound. But with regard to most of the conditions which injuriously affect the health of employees, or which have a relation to the employees' safety as conditioned by safety devices, ordinary intelligence, plus the power of intelligent observation, is sufficient. But granting this, an intensive industrial investigation is a difficult task, than which perhaps no public function requires to be approached with more genuine humility and diffidence.

It is not a difficult matter to conceive of ideal conditions of work, and most of all is it easy to condemn the employer and relieve the employee of all responsibility. But it requires a trained mind to ascertain the necessary facts and to draw conclusions which can be practically applied to the more or less apparent needs for drastic reform. Investigations of this kind are laborious and should not be undertaken by those who are easily fatigued or confused.

The sole object in view is to ascertain the truth and to ameliorate, as far as possible, the conditions of labor, so that those who are the real producers of the nation may not pay the price of industry in an excessive amount of disease or premature invalidity and death. There is no more useful function in society than that of the earnest seeker after truth in matters of this kind, and there is nothing more creditable to any nation than actual progress in industrial hygiene and the prevention of needless industrial accidents. On a very conservative basis, twenty-five thousand lives are annually lost in the United States as the result of industrial accidents, which is the tribute paid in lives by some thirty million toilers who carry on the nation's work. What the tribute is in ill health and invalidity no one is at present in a position to estimate even with approximate accuracy upon the slender basis of data available. But granting that the relative occurrence of industrial disease is greater in Germany than in this country, and taking only half the calculated amount of sickness on the German basis, the figures are as startling as they are suggestive of the imperative need for the most patient, the most disinterested, but at the same time the best qualified methods of research in industrial hygiene.

It requires no argument, therefore, to emphasize the need for a thorough understanding of the essential facts of industrial hygiene as a preliminary requisite for intensive investigations into the conditions inimical to health and life in industry. The historical method has obvious advantages in that it brings out with reasonable accuracy the progress which has been made by the complete elimination of some of the worst conditions injurious to the health of wage-earners in the past. The treatise by Ramazzini, published for the first time in English in 1705, is a textbook which may still be consulted to practical advantage, and it is to be hoped that some time this exceedingly rare work will be reprinted. Tissot's *Essay on the Disorders of the People of Fashion, and the Diseases Incident to Literary and*

Sedentary Persons, published in 1772, is also quite suggestive; and the same may be said of Thackrah's treatise on *The Effects of Arts and Professions on Longevity,* published in 1832. There is much valuable information in Gaskell's book on *Artisans and Machinery, and the Moral and Physical Condition of the Manufacturing Population*; but one of the most suggestive works on occupational diseases is *The Vital Statistics of Sheffield,* by Holland, published in 1843. There could be no more serious error than to assume that the health-injurious consequences of occupations are limited to the mechanical industries, and it only requires to be pointed out that the proportionate mortality from tuberculosis of the lungs at ages from twenty-five to thirty-four among salesmen is 46.7 per cent. In 1884 Thomas Sutherst, a barrister-at-law, published a very suggestive work, with numerous cases, on *Death and Disease Behind the Counter,* intended as a protest against the more or less unnatural conditions of shop labor.

These are the earlier works of reference, which have since been partly replaced by the *Handbook on Occupational Diseases,* by Arlidge, followed by the standard work of reference on *Dangerous Trades,* prepared under the editorial supervision of Sir Thomas Oliver, who about two years ago published a compact textbook on *Diseases of Occupation,* which can be consulted to great practical advantage on the group of occupations to which the work is limited. There are a number of German and French textbooks on industrial hygiene which have not their counterpart in English. Foremost among these is the great work prepared under the editorial supervision of Weyl, including observations on the "General Principles of Industrial Hygiene and Factory Legislation" which have for their specific object improvements in conditions affecting safety and health in industry. An excellent manual in German is a treatise on *Industrial Hygiene,* by Holitscher, and there is a book by the same title published in 1906 by Dr. Bender, a medical factory inspector of large experience. Special reference should be made to two small manuals of advice to German boys and girls about to enter a trade, which have particular regard to the physical requirements and the mental adaptation to particular industrial processes. Manuals of this kind, obtainable at a cost of a few cents, convey the required information in the most effective manner, but the suggestions contained therein are also of practical value to the student of industrial hygiene.

Research work on a larger scale is much facilitated by the *Index Catalogue of the Army Medical Museum and Library,* for some of the most useful and instructive discussions of special phases of industrial hygiene and the medical consequences of industrial accidents are the occasional contributions by practicing physicians to the medical periodical press. A thorough study of the available medical literature relating to occupational diseases and occupational neuroses is imperative, for even the most earnest seeker after information may fail of his or her purpose on account of lack of the required preliminary training. As has been previously pointed out, the recent legislation on workmen's compensation and the tendency in the direction of drastic and far-reaching laws make investigations into the field of industrial hygiene and accidents of great practical importance. Those who have had to do with the settlement of *Claims Arising from the Results of Personal Injuries* appreciate the value of a work with this title by Magruder, and of the larger treatise on the *Causes of Disability,* by Harbaugh. A most useful handbook in this connection is Saunders' *Medical Hand Atlas of Diseases Caused by Accidents.*

In brief, the present plea is for scientific methods in intensive investigations in the field of industrial hygiene as a first requirement for the attainment of really useful and conclusive results. Probably no other field of systematic research offers such exceptional opportunities to the earnest seeker after truth, and certainly none is more likely to prove of great benefit to the mass of mankind. In justice to employers, whose every effort to improve conditions inimical to health deserves encouragement, and in equal justice to employees, whose health and well-being are menaced at the present time by conditions more or less unsatisfactory, it is of the utmost importance that so difficult a task should be approached with a due consideration of the seriousness of the problem, the need of a scientific method, and the duty of absolute impartiality. The object of all investigations of this kind is not to prove or sustain any particular conclusion arrived at in advance, but to determine the truth and the facts as they actually exist and as they condition at the present time the health and well-being of the men, women, and young persons employed in productive industries.

COMPULSORY REPORTING BY PHYSICIANS

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Compulsory reporting of industrial diseases by physicians constitutes the first step in the campaign for prevention, if the latter is to be comprehensive and scientific. It is a case of an extensive evil known to exist in various forms, in divers places, and from a variety of causes, but also known to be in large measure eradicable if only we can discover its various forms, their location, and their causes. If, therefore, preventive efforts are to be directed so that they may be at once comprehensive in scope and intelligently effective in detail, knowledge of the frequency, incidence, and sources of the evil are of prime importance.

Furthermore, it is safe to say that the prevention campaign only awaits the necessary knowledge of the evil to be assured of success. The propriety of the exercise of the police power of the government in the interests of public health, which means the health, not only of all the public, but of any particular portion which may be subject to peculiar health hazards, has long been recognized, and public sentiment was never more quick than now to back laws for such a purpose, while private initiative, stimulated by public sentiment or moved by humanitarian motives, has never inspired greater activity than now along these lines.

If, then, prevention waits only for adequate information, where shall this information be secured? Obviously for information concerning diseases the principal source technically equipped to serve as a reliable informant is the medical profession. Further, it is not essentially a case of calling upon physicians to go out of their particular field of work, because practically all cases of occupational disease, serious enough to be important, come to physicians automatically, so to speak, in the course of their regular professional practise. In this aspect, compulsory reporting of occupational diseases is precisely like compulsory registration of deaths. It is simply the necessary requirement for bringing together by registra-

tion at one place scattered data which come under the eye of different physicians in their regular work. That this registration of industrial diseases is usually to be made with a different department of government than registration of deaths, is due simply to the fact that special government agencies, in the shape of labor departments, have been developed for the safeguarding of the health of workers, just as health boards or departments have been developed for the conservation of the general health of the community. Registration of deaths, being significant for all phases of the public health, goes naturally to the department of government with the broader function. Registration of the diseases of industry goes, likewise naturally, to the department whose special field is health in industry.

But more important than analysis of the fundamental reason for laying upon physicians the obligation of registration of industrial diseases, is consideration of just what kind of information should be asked of them in connection with such registration.

It almost goes without saying, of course, that the first thing to be required in a registration certificate is the strictly professional matter of the physician's diagnosis of the disease. But if registration is to furnish all that is necessary, the physician must be asked to go beyond the narrowly professional function of diagnosis to consideration of antecedent causes of the patient's condition. The importance of the physician's taking this point of view can hardly be overemphasized. It is necessary because, to a large extent, it is the only means by which the physician can discover that diseases are occupational. When we speak of industrial diseases we are not dealing with a class all of which are clearly distinguished from other diseases by peculiarities of their own, so that identification alone affords, or necessarily suggests, their occupational character. On the contrary, we are dealing in large measure—probably when the full truth is known it will be found to be in largest measure—with ordinary diseases found elsewhere but which may be due to occupation and which can be identified as occupational only by inquiry as to the circumstances of the patient's calling. In a word, many occupational diseases are distinguished from others primarily by their causes, so that only by their causes can they be identified.

To put this matter in the concrete, there is one industrial disease, compressed-air illness or caisson disease, which is practically always

due to circumstances of occupation. And there are a few poisonings, the most notable example of which is—or rather we may now say, fortunately, has been—phosphorus necrosis, which are known to be due so frequently to occupation that they have acquired the name of *industrial* poisonings. There are also one or two infectious diseases, the leading example of which is anthrax, which likewise are so commonly associated with an occupation that they immediately suggest occupational causes. Even in these fairly well-recognized industrial diseases, however, the physician must go back of diagnosis to identify them as occupational in character, as witness instances lately reported in New York State of lead poisoning in the case of a schoolboy, of phosphorus and mercury poisonings in cases of children, and of anthrax in the case of a stock broker.

A more striking illustration of this point is another New York case in which only the accidental discovery of occupational causes prevented an absolutely incorrect diagnosis of a case of industrial poisoning. In a brewery in the state two men were employed last year in varnishing the inside of closed wooden vats with alcohol and shellac. After a day of such work one of them became violently ill and died during the night without medical attendance. The coroner's physician, on examination, found the cause of death obscure, but, on the strength of what he could discover by inquiry concerning the patient's illness, certified the cause of death as apoplexy. On the day of the funeral the physician heard that the other workman had become blind, and for the first time learned what kind of work the two men had been doing. Thereupon he procured a sample of the alcohol and shellac, had it analyzed, and found that the alcohol was wood-alcohol, with the result that both the nature of the disease and its occupational cause were revealed, and his certificate as medical examiner was accordingly altered to make the cause of death wood-alcohol poisoning. This is, of course, an extreme case, but experience in connection with the registration of deaths affords evidence that such errors are frequent enough to sustain the point here emphasized, namely, that even in the case of the more exclusively occupational diseases the physician must probe for causes back of his diagnosis if registration is to realize what is needed.

This extra-professional information which the physician must

be asked for, in order that the identity of the disease as occupational in character may be evident, at least presumably, comprises two items. First, and rather obviously, but none the less of most importance, is a careful statement of the patient's occupation and the industry in which it is pursued. Upon this, of course, all accurate statistical study of the whole subject depends. It is, likewise, the first necessary inquiry of the physician in determining the occupational character of the disease. Had the physician, in the case of wood-alcohol poisoning above referred to, looked at once for this item, which he accidently noticed later, doubtless his first certificate of the cause of death would not have gone so wide of the mark.

But, as already noted, comparatively few industrial diseases are caused exclusively by occupation. Many may, or may not, be occupational in character. Furthermore, even in the case of an exclusively occupational disease, other factors may also be present. Hence, in the second place, if we are to read correctly the responsibility of circumstances of occupation for disease, the physician must be asked to look for the other possible causes, and to report any factors other than occupation, such as complicating diseases or personal circumstances, which may be contributing or accompanying causes.

Now it is precisely in connection with this extra-professional information that the principal difficulties arise with physicians' reports,—that is, of course, after the primary task of bringing and keeping before physicians the necessity of reporting at all is accomplished. The reasons for this are natural enough, since all the necessary information as to occupational or other causes lies beyond the strictly professional interest and point of view of the average physician, and he must secure it by special inquiry outside of his purely technical duties. For example, when the New York law requires that all cases of occupational lead poisoning shall be reported, it means that every physician who may treat a case of the disease, after his professional work of diagnosis and prescription is attended to, must first of all remember that lead poisoning is to be reported, and that then he must make inquiry as to the patient's occupation, must ascertain whether any other factors enter into the case as causes, and must record this information with the necessary details, along with a number of other items as to sex, age, etc., all outside of his natural professional interest except as general obligation toward the public welfare may appeal to him.

To a large extent the difficulties referred to are those long familiar in connection with the registration of deaths by physicians, and simply argue that without doubt a long period of education will be necessary to secure general and accurate observance of a reporting law for industrial diseases. Indeed, so far as the report of diagnosis and the statement of occupation alone are concerned, the problem is precisely the same in both forms of registration. But when we come to that element in the reporting of diseases which virtually requires the physician specially to weigh the causative influence of occupation, as compared with other possible causes, there is a fundamental difference between the two. Registration of deaths requires a statement of occupation only as a simple addendum to diagnosis, and requires no consideration whatever of occupation as the cause of death. But such consideration is essential, as pointed out above, in the registration of industrial diseases. It is specifically implied, moreover, by the very terms of the New York reporting law which, like all but one of those in other states having such a law, follows the British act, and which requires a report from the physician for each patient "whom he believes to be suffering from (the specified diseases) contracted as the result of the nature of the patient's employment."

The most significant aspect of this peculiar source of difficulty connected with the reporting of industrial diseases is that it increases in importance as compulsory reporting may be extended from diseases known to be exclusively or mainly occupational to those whose sources may be either in occupation or in other circumstances, or in both combined. For, as we proceed in this direction, the causes of the disease become more and more uncertain and complex, with consequently increased difficulty for the physician who is called upon to determine, or at least to express his belief as to, the influence of occupation. Compare, for example, caisson disease and tuberculosis as to the relative difficulty of determining whether occupation or other factors were responsible for the disease.

This aspect of the reporting problem naturally suggests the question of how general the reporting should be made. As a matter of fact, reporting laws enacted in this country so far, here again in accordance with the British act, have limited compulsory reporting to a small number of easily identifiable industrial dis-

eases, namely, as in the New York law, poisoning by lead, phosphorus, arsenic or mercury or their compounds, anthrax, and compressed-air illness. All of the American laws are of very recent date and the wisdom, at the outset, of such limitation of reporting would seem to be clear from what has here been said. Nevertheless, if the problem of industrial diseases is to be treated broadly, and if the prevention campaign is to be planned on comprehensive lines, nothing less than an extension of registration to all recognizable industrial diseases must be considered as the ultimate goal.

This may appear, at first sight, to be only an ideal whose consideration may well be postponed for the present. But a rather interesting experience in New York State has brought it forward for immediate consideration. The New York reporting law took effect in September of last year. Prior to that time notices of the law were sent to medical journals, and shortly thereafter a circular notice and sample forms for reports were mailed to each of the 13,700 physicians, hospitals, and dispensaries in the state. The form adopted for reports was patterned after that used in Great Britain, was kept as simple as possible, and was limited to the few items specifically mentioned in the law, without taking advantage of a blanket clause permitting the inclusion of other items of information. The form was made thus simple with the express idea of encouraging reporting by making it as easy for the physician as possible. (It may be remarked, parenthetically, that the nine months' experience so far makes it very evident that something besides making it easy will be required to make reporting general, even with a very limited list of diseases). But the law had not been in force three months before we were met by the suggestion, from members of the medical profession itself, that we were not calling for enough information in our report form and that reporting ought not to be confined to the diseases mentioned in the act, some of which were not so common or serious as others not included. This was, indeed, far from being a general clamor from the profession as a whole, but it was an earnest expression of opinion from a few prominent members in New York City, who are interested in the subject.

The question of the extension of reporting to all industrial diseases thus raised, it must be confessed, in an unexpected quarter, but in the very one to make it the more to be regarded, became then an

immediately practical one in New York. To come at once to the result of the matter, the New York Department of Labor proposes to ask the cooperation of physicians to the extent of reporting all industrial diseases, and is just completing the work of inaugurating such extension. The reporting law has not been amended for this purpose, but it is proposed, for the field outside of that specified in the law, to rely for the present, at least, upon the voluntary cooperation of physicians.

While New York, relying upon a cue from members of the medical profession itself, thus proposes to start at once definitely toward the ultimate goal, it will be evident from what has been said in this paper that the difficulties of this larger program cannot be overlooked, and a word or two as to practical means of meeting these difficulties is in order.

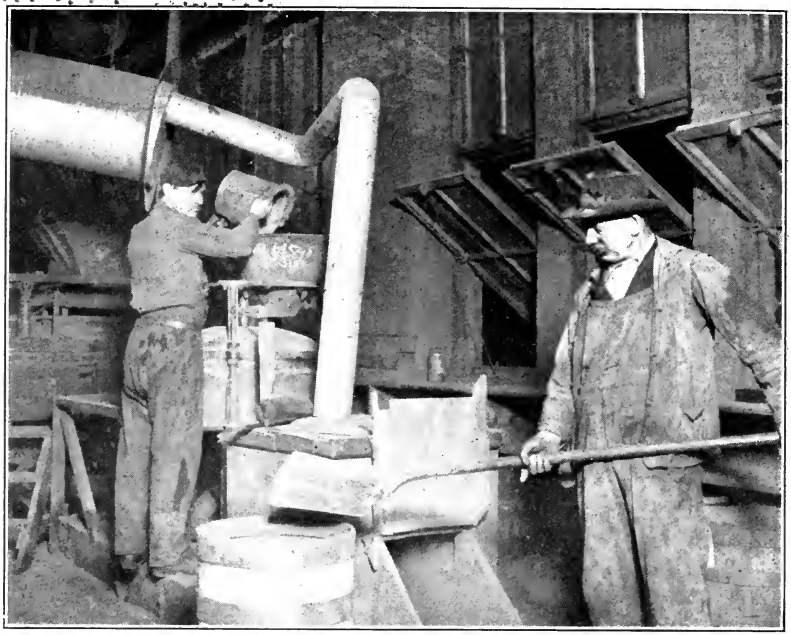
Government offices to which reports are to be made have two chief means of overcoming the difficulties referred to. The first of these is a carefully prepared form for reports, which shall clearly indicate the information needed. For this there may be commended one worked out by the committee on industrial diseases of the New York Association for Labor Legislation, and recently adopted with some modification by the New York Department of Labor in connection with the extension of reporting above alluded to. This form is indorsed by the committee on uniform schedules of the national Association for Labor Legislation, which recommends it as a standard schedule for use in all states. But, as repeatedly suggested in the foregoing analysis of the reporting problem, ultimate success must finally rest to a large extent upon the active interest of physicians. A second aid to reporting, therefore, may be found in the circulation among physicians, for their assistance and to stimulate their interest, of information concerning industrial diseases. For an example of this, reference may be made to a booklet recently issued by the New York department, containing brief descriptive matter and a general classification of industrial-disease hazards, with a list of the more important harmful substances and their effect upon workers. Reference to this may be made by the writer with all modesty because, for the material, the department is largely indebted to representatives of the New York Academy of Medicine, especially to Dr. W. Gilman Thompson of the Cornell University Medical College.

In the foregoing, compulsory reporting of industrial diseases by physicians has been considered only in its general aspects and chiefly from the statistical point of view. From that point of view the problem of accuracy and completeness of reporting are matters of foremost importance. It has been made clear, perhaps, that the solution of these problems will be a matter of considerable time and education, a conclusion which is supported, not only by analysis of the problems, but by consideration of the number and character of the reports produced by nine months' experience in New York. But, lest a wrong impression as to the value of reporting should be given by this technical view of the matter, two practical results, already clear in New York experience, may be mentioned in conclusion.

In the first place may be noted the very active interest among a number of influential members of the medical profession which the reporting law almost immediately aroused, or at least crystallized into activity. This has already been alluded to in connection with the assistance it has lent the department of labor with reference to reporting. The most significant fruit of it, however, has been the formation of a permanent committee on industrial diseases under the auspices of the New York branch of the Association for Labor Legislation, six members of which committee are physicians connected with medical colleges and leading hospitals in New York City. The value of such active cooperation of the medical profession in the campaign for industrial hygiene, going far beyond mere reporting of diseases, can hardly, of course, be overestimated. If the reporting laws of the seven other states in which such laws have been enacted, have revealed possibilities of this kind such as have appeared in New York within the first few months under its law, the work of the American Association for Labor Legislation, in securing the enactment of these laws during 1911 and 1912, must be regarded as marking the beginning of a very important forward movement.

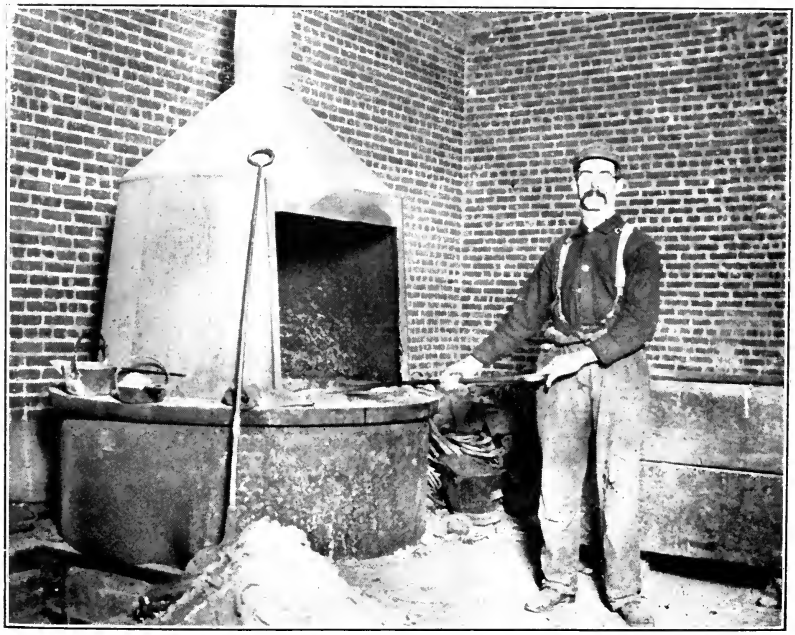
In the second place is to be noted the practical value of reports of industrial diseases as indices of points of danger, for the guidance of factory or medical inspectors. This is a value which may be realized practically from the very moment that reports begin to come in, without regard to the statistical problems of reporting. Each individual report at once invites attention to an establish-

ment or an industry for investigation with a view to preventive measures, and as reports multiply the field demanding attention becomes more and more clearly indicated for the inspector. To illustrate, the medical inspector of factories in New York State is just beginning a special investigation of lead poisoning. As a result of only six months' returns under the reporting law, the medical inspector may begin his work with definite knowledge at the very outset of fourteen different manufacturing industries and of one or more particular establishments in each of those industries, in which conditions positively known to have caused lead poisoning are offered for immediate application, or study, of preventive measures. Here again, therefore, the enactment of reporting laws in eight states must be regarded as marking a very important step forward in the practical preventive work of the factory and medical inspector, and prevention is, of course, the ultimate goal in the whole matter.



MAKING LEAD COLORS

Pouring Pigments Into Grinding Machine and Sprinkling Color Solution With Lead Litharge



LEAD CASTING, SHOWING LEAD POT IN A SMELTER

Danger of Poisoning is from Breathing Lead Oxide, Fumes and Dust. The Worker in this Picture Now Loses on an Average One Day a Week on Account of Chronic Lead Poisoning

LEAD POISONING IN NEW YORK CITY[1]

EDWARD EWING PRATT
New York State Factory Investigating Commission.

It has often been said that, compared with foreign countries, there has been and is very little lead poisoning in the United States. Recent investigations, however, throw considerable doubt upon these conclusions. The Illinois commission, during the years 1908, 1909, and 1910, found five hundred and seventy-eight cases of lead poisoning in that state alone. Last fall a hasty study of lead poisoning in New York City revealed three hundred and seventy-six cases which had occurred during the years 1909, 1910, and 1911. And during the year 1911 alone there were found one hundred and twenty-one cases. This study was based largely upon hospital records, and therefore includes only the more serious cases; a vast number of less serious ones must have been treated in dispensaries and by private physicians. These facts are startling when we think that in England during 1910 there were only five hundred and five cases. In a single year New York City had one hundred and twenty-one cases,—all England five hundred and five.

These cases of lead poisoning were not confined to any one trade or industry, but were scattered through a considerable number. The industries represented, in which the victims had been employed, were the following; white-lead, lead-acetate, lead-oxid, dry colors, use of lead as a hardening agent, scaling paint on battleships, ship-calking, diamond-polishing, printing, carpentering, plumbing, tin-smithing, and painting.

A canvass of the hospitals in New York City was made, and all the cases of lead poisoning or plumbism which they had treated during the last three years were selected. Names and addresses of the persons and any other available facts were taken from the hospital records. These records were lamentably lacking in everything that

[1] The facts given herewith are taken from a study made last fall and winter, by the writer, with the cooperation of a number of his students, and submitted to the N. Y. State Factory Investigating Commission.

would interest anyone who wished to make a study of lead poisoning and its causes. In only two hospitals in Greater New York were occupations specified more accurately than "laborer", or "painter", and in these two exceptional instances the information was not more detailed than the statement, "lead worker", "molder", "carriage painter", etc. No hospital recorded where the victims had worked, or under what conditions. However, with these names and addresses, and a few which were furnished by the New York State Department of Labor, the labor unions, the board of health, and several employers, the men themselves who had been leaded were visited.

It was not always easy to find the people we wanted, for, in addition to the difficulties due to false addresses, which are habitually given at hospitals, we found it difficult to locate Poles, Slavs, Russians, Lithuanians, Italians, and others of our recent immigrants. I remember searching for a man named John Sichosk, whose name had been sent in by the department of labor. At the address given, only the blankest faces answered my inquiry for John Sichosk. In broken English one of the men explained that he knew no one by that name. As a last resort I showed the record card with the typewritten name. The man's face lighted up at once, "Oh! John Sichosky! Sure, he live upstairs." He was there all right, and before the afternoon was over John had taken me to five others who had been leaded in the same factory.

A careful study was made of each case. The facts, not only about the man's last job, but concerning others as far back as he could remember, were ascertained. As far as possible the maternal history of the wife was obtained, the personal habits of the worker, and the precautions or lack of precautions in the factory. One hundred and nine cases, in all, were intensively studied in this way. The results are interesting, even if the small number of cases somewhat detracts from their value. In general, these results are similar to the results of studies made abroad.

Practically all the various forms of lead poisoning were found, ranging from light attacks of colic to death. Among these cases were several of wrist-drop and paralysis. Many of the workers had had recurring attacks and had been disabled for considerable periods, varying from a few days to almost a year. About half of the men were comparatively young; in fact, fifty of the one hundred and nine were actually less than thirty-five years of age, and

almost one hundred were less than fifty-five years of age when they became leaded.

Economists of the old school have always held that men's wages increase with the dangers and risks of their employment. This is certainly not true of lead workers. Over half of the workers studied (fifty-eight) were earning less than $16.00 per week; a quarter (twenty-three) were earning less than $12.00; and over a tenth (thirteen) were actually earning less than $10.00. Strangely enough, the most dangerous of all the industries paid the lowest wages. In the white-lead industry not a single man was earning over $14.00 per week, and many of them were earning less than $10.00. At these low rates one would imagine that the total loss of wages due to lead poisoning would be comparatively small. It is not surprising, therefore, that most of the losses were of small amounts, and that fifty-nine of the one hundred and nine men lost less than $150 each. But it is a surprising fact that some of these workers lost larger sums, seven men actually losing over $1,000 each.

Some very interesting facts were brought out in the analysis of conditions in the factories and workshops. Sixty-two of the one hundred and nine workers ate in the same room where they worked; twenty-two never washed before eating and forty-five washed only in cold water; seventy-three, or almost three-fourths, were never given oral instructions of any kind as to the dangers of their work or as to methods of preventing lead poisoning; seventy-six men never saw any posted instructions where they worked. It is usually admitted that men addicted to alcohol are more liable to contract lead poisoning, as they are to succumb to most other diseases. Employers delight to say that it is only the "hard drinkers" who are ever troubled by lead. But only six of the one hundred and nine men were found to use alcohol to excess; sixty-five were moderate drinkers; and thirty-one were teetotalers. These facts point out and emphasize the importance of the problem, right here and now in this country, and the need of prevention, the first steps in which have evidently not been taken by the majority of employers.

Of the one hundred and nine cases studied, seventy-nine persons were married, among them forty men whose wives had been pregnant while their husbands were employed at lead work. In all there had been one hundred and fifty-seven conceptions among these forty

wives. There were born to the persons one hundred and forty-four children, thirty-nine of whom died in the first year, and two in the second. The cause of death in many cases was malnutrition and convulsions. In addition, there were four still-births and eight miscarriages; and the latter figures understate the facts, as our information on this point is not full nor very accurate.

The effect upon reproduction has long been noted. Some interesting cases have come to my attention:

1. A young Hungarian came to this country in 1904. He worked in a wire mill, where the wire is tempered and hardened by being passed through a bath of molten lead. The lead is uncovered, and vapors and oxids fill the air. He married in 1909. In the same year his wife miscarried at the end of seven months. Early in 1910 a second child was born but died of convulsions within two weeks. About this time the husband had a severe attack of lead poisoning and was given another job. In January of this year the wife gave birth at full term to a normal child.

2. A Barbadoes negro came to the United States in 1908. He was married and had a little daughter, at that time two years of age. He found work in a lead factory handling and packing sugar of lead, or lead acetate. The following year his wife miscarried at the end of seven months. A year later a child was born at full term, but died in convulsions when six months old. The curious part of this case is that the worker himself was unaffected until a few months ago and until after the birth last referred to.

3. James Scott was a printer for over forty years and died of lead poisoning. He was married in 1868. Of twelve births six children survived, four died from various causes during their first year, there was one still-birth and one miscarriage.

4. Alexander Joronsky, a Pole, came to this country in 1891. After having various unskilled jobs, he found employment as a stripper in a big white-lead factory. During his period of employment as a stripper his wife gave birth to four children; one of these was still-born, and the others lived four days, three days, and one day respectively.

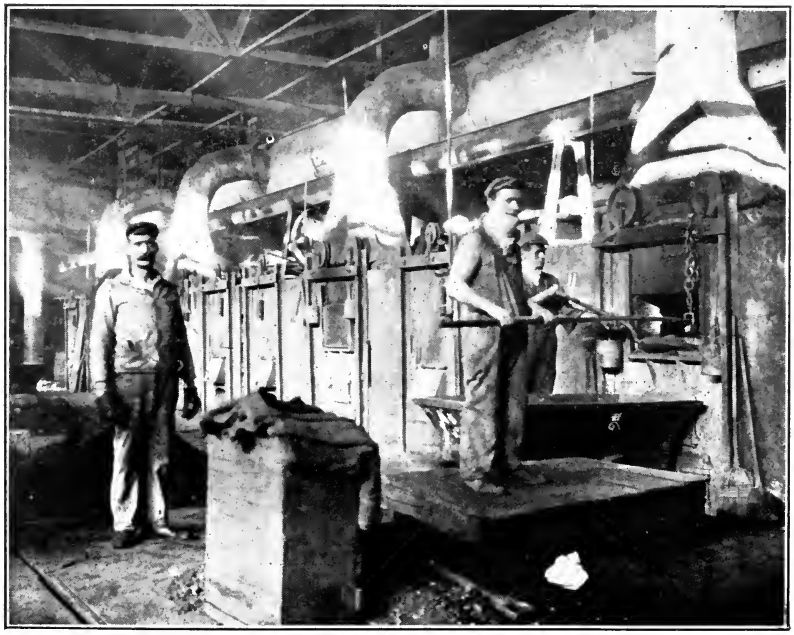
5. A Hungarian painter, who came to this country in 1893, presents an interesting case. Five of his ten children died within a year of their birth and his wife has had two miscarriages. The man himself, however, had his first attack very recently.

The investigation of hospital cases at once opened up numerous others, and also gave us clues to factories where there were lead processes of which we did not know. The next step in the investigation, therefore, was the inspection of factories.

One of the first cases which came to our attention was a pathetic case of double wrist-drop. The victim, a man of middle age, had worked in a magneto factory. It was a big place, with many hun-

DUST COLLECTORS IN A LEAD PLANT

Cloth Bags Permit Air from Exhausts to Pass Through While Retaining Lead Dust Which Falls Into Bins and is Saved. In Up-To-Date Plants the Bags Are Shaken by a Mechanical Device Operated from Outside of Dust House



EMPTYING A RED-LEAD FURNACE

When Oxidized in Furnaces the Lead is Raked Out Into Cars. In Spite of Powerful Exhausts and Hoods Some Dust Floats in the Air and is Breathed by the Workers

dreds of employees, but the lead process was carried on exclusively in one small room, a sort of lean-to at the rear of the factory and a little below the level of the ground. Here were located five lead pots, the temperature of which varied from 800 to 1500 degrees. These pots, when inspected, were covered by hoods leading to a chimney, but were not provided with any blower attachment. The roof was raised slightly and a fan at one end gave a fairly good air circulation. In the process preceding the so-called "hardening", bars of steel are bent into the horseshoe shape of a magnet. They are then brought into the hardening room and immersed in a bath of molten lead. There they remain for a specified length of time, when they are removed and suddenly immersed in water. After cooling they are stacked up, one above the other, and are rubbed down with sandpaper to remove any particles of lead that remain. This process, at the time when the inspection was made, had been in operation for less than a year and nine men were employed at it. I found seven cases of lead poisoning; one had resulted in death, and one in double wrist-drop; others had necessitated long periods of unemployment.

A wire mill carried on a similar process. Here the tempering and hardening is done by passing the wire slowly through a bath of molten lead. The wire is wound on huge spools revolving slowly, and is then wound onto another reel. The room is habitually full of smoke, gas, and fumes, and the men work intolerable hours,—two shifts of twelve hours each, with no time for meals. They have to snatch what they eat,—because the lead positively cannot be cooled off.

In both of these processes the danger comes, I believe, not from the fumes of molten lead, but rather from the particles of lead oxid which probably fill the air. In both cases the skimmings from the lead pots are brushed carelessly aside and allowed to fall upon the floor, or to accumulate in piles beside the pots.

Some of you will wonder how a girl working in an embroidery factory can be poisoned by lead. You will doubtless scoff at the possibility of a worker on embroidery contracting lead poisoning. But I have found two such cases. The designs to be embroidered are stenciled on cloth. This is usually done with a mixture of chalk and talcum powder. One resourceful employer, however, observing the way in which the chalk rubbed off, substituted dry

white lead, which clings more tenaciously. The girls who used it were ignorant of its poisonous character and handled it as carelessly as they had handled the chalk. They pounded it into the stencils and the dust rose in their faces and the lead covered their hands. Little wonder they got lead poisoning. The use of lead for this purpose is common.

Another case, which is individually the most pathetic I have seen, is that of William O'Connell. O'Connell has now been out of work for about eleven months and is likely to remain so, as he is totally incapacitated. The interesting and exasperating thing about it is that he is our employee,—speaking collectively,—because O'Connell was in the employ of the United States government, immediately under the Navy Department and a worker in the Brooklyn Navy Yard, where his job was that of "scaling" in the double bottoms. Battleships are provided nowadays with double bottoms, a shell which envelops the entire keel of the ship; between these bottoms is a space of about two and one-half feet, which is divided into compartments of from four to six feet square. In order to prevent rust these double bottoms are painted with red oxid of lead, sometimes to a thickness of one-fourth of an inch. The process of scaling consists of scraping off the red oxid paint with an automatic compressed-air chisel called a "hammer". When in operation this hammer throws a spurt of dust up into the faces of the workmen, who wear goggles but no respirators. Sometimes several men work in one small compartment, and they tell me that it is almost impossible to see the electric bulbs at their elbows. "And then when the air hose breaks, you ought to see the place!" one of the men remarked. Think of working in such a place for eight hours a day! It is any wonder that, out of a squad which averaged about fifty men, we found twenty cases of severe lead poisoning, including two deaths and O'Connell, who is totally incapacitated? And these men have no washing facilities, they wear no respirators, there is no exhaust, there are no accessible eating facilities, there is no medical inspection, and they get no compensation. The government gives no compensation for lead poisoning because, technically, it is not an accident,—which is true, for under the circumstances it is a dead certainty. Yet the surgeon of the post asked me,—a layman,—"Why! is that work dangerous?"

Other industries contributed their quotas of lead poisoning cases.

One firm, manufacturing white and red lead, reported through its physicians twenty-four cases from October, 1910, to October, 1911. We dug around a bit and found a dozen more. About two hundred men were exposed. In another white-lead works, where the factory had been running with about two dozen men, we found eight cases diagnosed by the factory physician. In another white-lead factory the superintendent claimed that no case of lead poisoning had ever occurred during his ten or a dozen years there; for, said he, "We send a man off when he shows the first signs of being leaded." The next Sunday I saw five men who had been leaded in that plant, and who had been out of work for periods varying from a week to almost a year. One poor fellow had had four separate attacks and had gone doggedly back to the same job. Just the week before, when he was suffering severely from colic, this same superintendent had on two occasions sent a messenger to him asking him to come back to work.

Of all the industries which I have studied, painting, especially interior decorating, yields more lead poisoning than any other, not proportionately but in the total number of victims. Man after man had the same tale to tell,—a long job, close interior work, sandpapering, stipple, painting, more sandpapering and more painting, a sudden overpowering attack, and a period of sickness and idleness, leaving him just at the end of the busy season when it is impossible to find work.

It does not occur to many of us that in New York, at any rate, a building in course of construction is absolutely (with one or two possible exceptions) without the pale of the law. And yet any new building in course of construction in New York City has constantly working in it from two hundred to six hundred, or even more, men. These men are usually working under almost intolerable conditions, with a complete lack of sanitary conveniences, no washing facilities, no provision for eating, and no attention to health or hygiene. Many a painter has related to me how impossible it is for him to wash his hands for lunch, and how he is forced to hold his sandwich between two pieces of paper in order to keep his lead-covered hands from coming in contact with his food. It is not a difficult matter for a builder to safeguard his painters. He can use zinc white, which is better in some ways than white lead and is but slightly more expensive. In fact, one of the biggest so-called speculative builders in New York City now specifies white zinc and wet sandpapering.

We have now acquired in this country, I believe, a body of evidence which demonstrates the prevalence of lead poisoning and other industrial diseases. They may not be as prevalent as abroad, but I doubt it. The industries in which these diseases are found employ unskilled, non-English speaking workers, who pass quickly from one industry to another, and who seldom come under the observation of the authorities.

In preventing industrial disease, especially lead poisoning, an educational campaign is, it seems to me, the thing of prime importance,—education of the worker and education of the employer. The first step in the education of the employee is a knowledge of the rudiments of English, then the simple rules for the care of health and self which are so effective in preventing lead poisoning. The employer, on the other hand, should be told that there is such a thing as lead poisoning, and then how to prevent it and how to treat it. There are many employers who are willing and anxious to safeguard their workers. One white-lead manufacturer is spending $20,000 on prevention. He may not be doing it in the right way, but he has got the right spirit and will doubtless do more,—more in fact than he could be forced to do. Then, let us bring on the legislation and force the recalcitrant employers into line.

GENERAL DISCUSSION

1. Lead Poisoning

Mr. F. V. Hammar, *President of Hammar Brothers White-Lead Co., East St. Louis, Illinois:* I think the pictures shown by Mr. Pratt demonstrate one fact, and that is that all lead poisoning comes from lead dust. Factories can be made sanitary by the elimination of dust. This statement relates, not to industrial poisoning as a whole, but to white lead, and is based on experience in my own factory. We are not appalled by the lead menace. Our record of twelve years is not one death, either in our lead smelter or in our white-lead works, and in the past eleven months we have had but four reportable cases under the Illinois law, and the loss of labor was not to exceed fifteen to twenty days. The experience of those who have been reasonably successful in controlling lead poisoning, with a view to minimizing the laborer's loss of wages and preventing any danger to his future health, should be of interest.

No consideration of the sanitation of lead works is valuable until the avenue of entrance of various poisons, dusts, fumes, or gases into the human body is satisfactorily settled. If you do not know how toxins get into the body, you have little hope of knowing how to keep them out. Lead poisoning seems to be particularly productive of theories as to causes of inoculation. But, as a practical fact, lead is non-poisonous until brought into contact with the fluids of the alimentary tract, chiefly hydrochloric acid in the stomach. Undissolved lead is no menace, and only when dissolved by the organic fluids is it absorbed into the vascular system. Such solvents are lacking in all organs except the alimentary tract. Therefore the skin, abrasions of the skin, the scalp, under the finger nails, and even the lungs, are not avenues of entrance of toxins. If they were, they have little if any power of converting sufficient lead salt into soluble poisons and absorbable solutions to be a serious menace to health. There is no doubt but that mild plumbism may result from lead hair dyes and lead face powders, and that lethal quantities may be forced into the pulmonary organs of a cat, but the menace of

such special conditions is so rare and so slight that, for general purposes of sanitation, we may assume that the only avenues of entrance are the nose and the mouth, and that the only place of conversion into absorbable liquids is the alimentary canal.

The cardinal principle of lead-works hygiene, therefore, is to prevent the lead salt, in any form, from entering the nose or mouth. The first necessity is to inform all workmen of the danger of lead poisoning,—that it comes from working in lead dusts; that the first symptoms of intoxication are constipation and colic; and, of great importance, that as soon as they notice alimentary disturbances, they are to report at once to the foreman and to the factory physician for treatment.

That men may work in a minimum of dust, forced drafts, hoods, and artificial ventilation are necessary. It is generally recommended by authorities that floors should be of such material that they may be flushed daily, and this is most desirable. If all lead works could be rebuilt, for this and other economical reasons, they would have concrete floors. But we believe forced drafts are more efficacious than flushed floors because, while it is most desirable that floors should be clean, the first truck or barrel that passes over them drops some lead salts, and the quantity on the previously clean floor accumulates in proportion to the work done during the day. Lead salt is, as a rule, of high specific gravity and only a small proportion of the siftings are carried into the air. As a result, while the floors may not be immaculate, the ventilators soon remove floating particles, and leave the air cleaner and more sanitary than where the floors are flushed daily without the forced draft and ventilation.

There is no doubt in our minds that under all circumstances and conditions, no matter how perfect the ventilation and cleanliness, wherever lead dust is in the air the workman must wear a protection over the nose and mouth. We have to some satisfactory extent perfected a "mask" that is inexpensive, affords a maximum area for air filtration, and, once it becomes damp from the laborer's breath, is an excellent protection against dust. The workmen wear these masks without objection, and the results are very encouraging. There are places in all American factories where fans, drafts, or flushed floors are impossible. In these departments the workmen are forced to wear masks, the circulation of air is as free as possible, the hours of labor are reduced to a minimum, and the physician

gives his especial attention to the men employed. Our records show that, by these means, the menace is reduced to a minimum. We find it essential to separate the dusty departments from those where no dust originates, for the men who handle lead in oil never suffer from plumbism, and in the latter department the liberal use of ordinary floor oil is quite satisfactory. It fixes in place such dust as may blow in and assists in sanitation.

All of these suggestions are only coordinate with shower-baths, washing facilities, places for eating outside the factory, frequent sweeping, and above all constant vigilance to see that the laborer realizes the danger and uses the precautions furnished. But all these items are precautionary. The active and effective agency in the conservation of our workmen's health is an excellent physician. No system of prevention can be devised that will be so perfect as entirely to prevent plumbism among men of the small intelligence of the average day-laborer. The tendency is always to minimize the danger and to disregard positive orders regarding wearing the mask and proper cleanliness in eating. Therefore men do get lead colic, and they often neglect to report it until it becomes severe. In fact, such serious cases as we have had have almost invariably arisen among strong, vigorous young white men who, in the egotistical belief that nothing can hurt them, neglect, as far as they dare, our regulations for their protection, especially in emergencies. That we may treat cases in their incipiency, our physician personally sees all the workmen every Friday. The men whom he suspects of intoxication are held for personal examination. His experience enables him to spot a suspect at sight and a few words completes the diagnosis. There is a great advantage in reaching the case in its incipiency, when a spoonful of Epsom Salts will effect a cure.

There is no doubt that white lead is a menace. But there is also no doubt that this menace can be controlled. For such control regulation and law are necessary. We believe in legislation for dangerous trades. The necessity for it comes, however, from ignorance rather than from essential danger. We believe that every man working in lead should realize how and why he may become intoxicated and, equally important, how he can avoid serious results. Legislation is necessary that this information shall be disseminated; and legislation helps the manufacturer by assisting him to enforce regu-

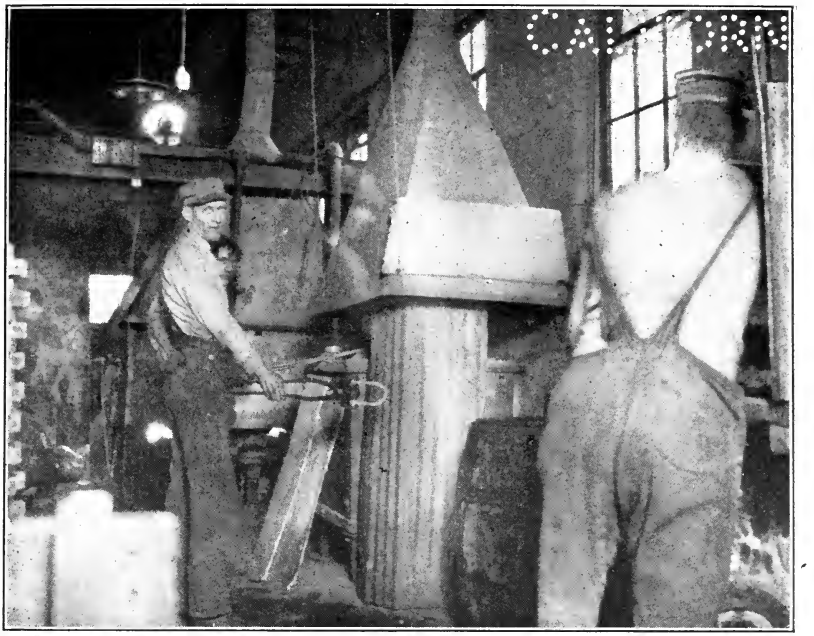
lations. That plumbism can be controlled to a satisfactory degree I know beyond a question of doubt, and if your Association can suggest any practical methods or regulations that will assist in removing the menace to labor, all white-lead makers will give you hearty cooperation.

DR. JAMES P. WARBASSE, *New York City:* I have listened with interest to this apology for the lead industries. But I think there is one point to bring out, that the lead industry is practised for the profit there is in it. There are satisfactory measures for protecting the lead worker, but I do not agree with the previous speaker that adequate means of protection are now used in any factory in the United States. The question of profit is the important side and it behooves us, as students of industrial diseases, to bear this fact in mind.

DR. J. W. FOSS, *Arizona:* The statement has been made that the only way a person can become poisoned from lead is through the intestines, and not through the skin. Only last evening Dr. Anderson of the Navy told me they had been making investigations of the poisoning of the men who chip off paint scales in the Brooklyn Navy Yard. They made tests and it was thoroughly demonstrated that in seven days you could get poisoning by rubbing lead on the skin. The investigations made by the Navy show that it is a great error to believe that you cannot be poisoned except through the intestinal tract, and that we ought not to allow this idea to go out.

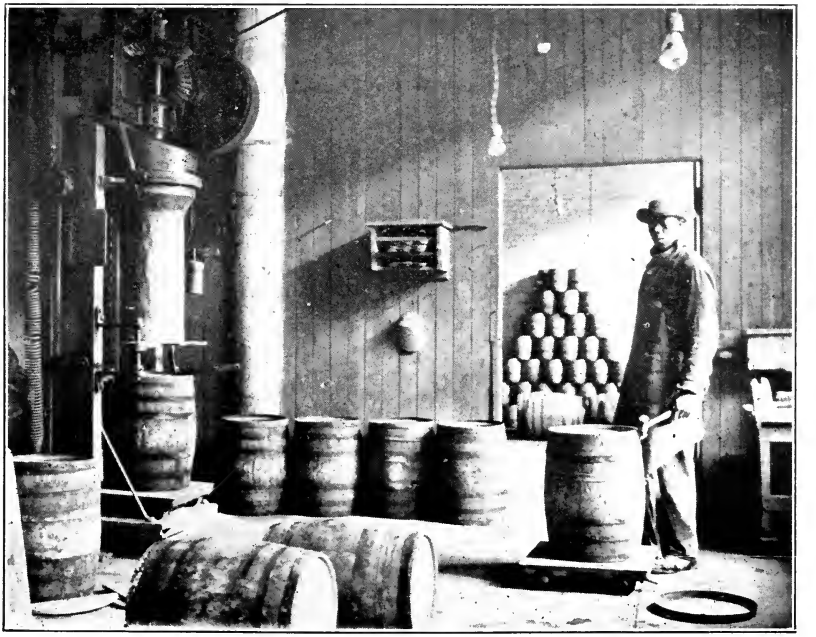
MR. HAMMAR: The men who work in the Navy wear goggles instead of respirators. I contend, very reasonably, that if they keep the dust out of their mouths they will keep it out of their systems. But I was speaking of white-lead works, and ninety per cent of lead poisoning comes from sandpapering and not from lead works.

DR. C. T. GRAHAM-ROGERS, *Medical Inspector of Factories, New York:* The fact that lead is absorbed through the skin and produces toxic effects is brought out by Rambousek of Austria and Roth of Germany, in works published within a year. The method of poisoning indicated by Mr. Hammar is the more usual, but most of the cases of lead poisoning occur among painters who are work-



LEAD USED AS A HARDENING AGENT

Steel Magnets Are Dipped Into Molten Lead Until Red Hot, Then Plunged Into Water, and When Cooled, Polished with Sand Paper. Workers Endangered by Fumes and Dust



HEADING UP BARRELS OF DRY RED LEAD

Deaths Due to Lead Poisoning from Breathing Dust in this Work Have Sometimes Been Reported by Physicians with the Occupation Given Merely as "Cooper". A More Specific Statement of Occupation is Needed to Reveal True Cause of Death

ing with lead paints. When they are employed in sandpapering paint and the application of oil is neglected, the poison is absorbed through the skin.

MR. JOHN VOGT, *New York Department of Labor:* I had the good fortune to accompany Mr. Pratt during his investigation, and from the many tests I made of the various oxids came to the conclusion that, where the dust was eliminated as much as practicable, the number of cases of lead poisoning was reduced.

PROFESSOR C.-E. A. WINSLOW, *New York City:* The great possibility of lead poisoning is getting lead into the mouth. It is an ordinary problem of sanitation.

DR. HAROLD K. GIBSON, *Illinois Factory Inspection Department:* Mr. Hammar's remarks are interesting. I believe he is, like others, making an effort to eliminate lead poisoning from his plant. It can be eliminated, but all the dust collectors and improved methods of sanitation and exhaust devices and washing facilities will not do it by themselves. After all, I think the decisive factors are strict personal supervision by foremen and the education of the men in personal hygiene. We have what we call two classes of manufacturers, those who comply with the letter of the law and those who comply with the letter and with the spirit. Mr. Hammar I know to be one of the latter class. All these measures, including sanitation, will not avail unless the manufacturer complies with the spirit of the law.

DR. JOHN B. ANDREWS, *Secretary, American Association for Labor Legislation, New York City:* A year and a half ago Mr. Hammar treated this subject at our annual meeting in St. Louis. I have often cited his work as an illustration of what can be done. There is need of labor legislation to bring other manufacturers up to his standard.

Mr. Hammar is also correct in his contention that the amount of industrial lead poisoning due to absorption through the skin is comparatively insignificant. Practically all industrial lead poisoning, leading authorities agree, is caused by the inhalation or the swallowing of lead vapor or dust.

Mrs. Florence Kelley, *National Consumers' League, New York City:* What is the use of teaching a man to shovel lead and then telling him it is harmful, yet paying him to keep it up. Is there any apparatus on the market to prevent that phase of the business?

Mr. Thompson, *Chemist, National Lead Company, New York:* I came here on account of our interest in this work. I want to say a word or two in supplement to what Mr. Hammar has said about dust. In our experience the dust is the dangerous element. In regard to mechanical handling, not much has been done on that question, but we are making progress. There is a phase in the manufacture of white lead not yet touched on, however, which illustrates one direction in which a saving of dust can be accomplished. From the time when you put the white lead in the factory, it may be handled in enclosed machinery and no dry lead dust produced until it is put in pans; and even that can be avoided by mixing it with oil. However, the trade requirements are such that this cannot always be done. Some painters will not accept such paint.

We need an educational movement, to be followed by such legislation as is necessary, and I am almost inclined to think, by the time the legislation is accomplished, the manufacturers will have done everything that will be required of them. We sympathize heartily with this work and want to help it along in every way possible. We are spending a great deal of money, from an economic standpoint, in washrooms and in new machinery. The policy of our company, and I speak authoritatively, is not to hold back the expenditure of money in any way which will assist in the prevention of lead poisoning.

II. Investigation and Reporting of Industrial Diseases

Dr. George M. Kober, *Georgetown University, Washington, D. C.:* The papers presented this morning are particularly valuable. Very naturally we inquire why there is such a paucity in American literature upon this subject. The reason we have so little literature is that we have had few original investigations, and I think it is exceedingly encouraging that the United States Labor Bureau is recently paying more attention to the question of industrial diseases. I consider that one of the most important duties the bureau can perform is to have expert investigations made into the conditions

affecting the workers' health. This example should be followed by our states. More money should be spent on original investigation, so that we may come into possession of facts to form a literature on the subject. Then we need the training of men and women to this work.

I believe the reason the Germans lead in literature of that kind is that they have a large number of medical officers connected with industrial insurance companies, whose business it is to prevent disease and who naturally give special attention to the investigation of factors which affect the welfare of workers. We may benefit the American laborer to a great extent by encouraging the employment of men whose business it is to give their entire attention to the health of the laborer. The ordinary workman often hesitates until he is really compelled to give up work before asking for medical advice. If he were in the hands of a physician whose duty it was to give attention at any hour of the day, he would ask advice at the earliest possible and most opportune moment.

I wish to make a strong plea for the reporting of all industrial diseases in every state in the union. Until we do this many diseases may be due to industrial causes but not be recognized as such. We should also train up medical men to be perfectly conversant with what constitutes industrial disease.

Dr. J. W. Foss, *Arizona:* I have had some experience in the reporting of diseases, and the question of what should be reported and what compensation should be paid. It would seem right to ask the labor organizations to cooperate, as they have recently done in Arizona in regard to the union label. They sent out letters to all the people who use printed matter asking them to use that label. If the physician is receiving his living from these people he will pay attention to their request.

Dr. William F. Snow, *California State Board of Health:* The California legislature of 1911 passed a law, recommended by this Association, requiring the reporting of six occupational diseases. The bill was essentially that formulated by this Association but with one minor change, that reports should be made to the state board of health instead of to the bureau of labor statistics. The state board of health then makes a transcript of the report and immediately forwards it to the bureau of labor statistics.

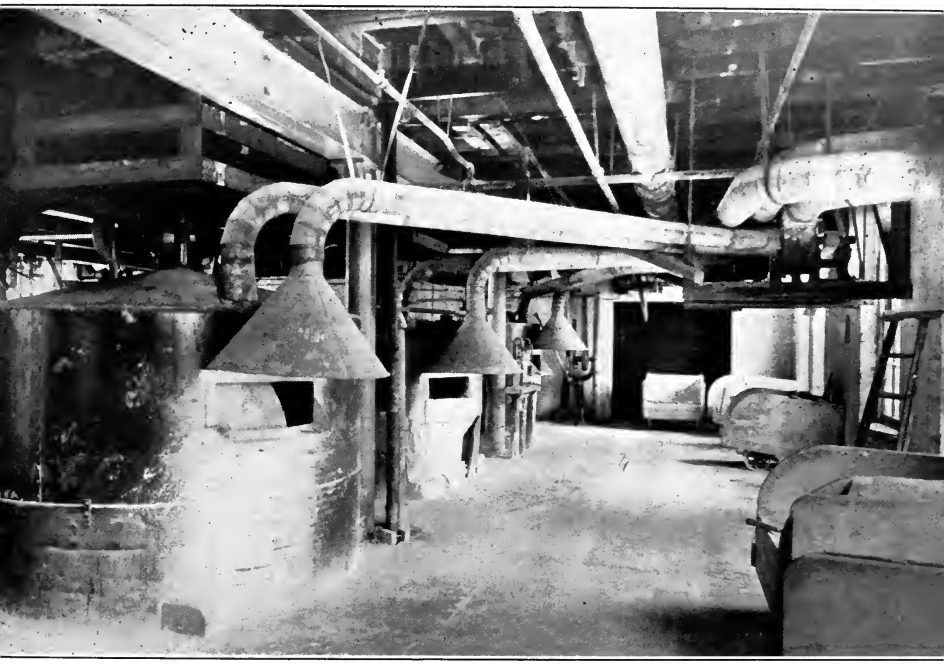
I think it possible that, when a careful survey has been made, we shall find that California does not have, under present industrial and limited manufacturing conditions, a large problem of industrial disease. We are doing some things, however, which may interest you. The labor bureau is in touch with the labor associations of the state and I have given them a list of all the occupations which we thought might be productive of industrial diseases. We have tried to get the names of the secretaries of all the painters' unions and of all the printers' unions. We are also trying, in the principal cities, to obtain information in regard to diseases which are not reported. That is joint work of the health and statistical boards.

The physicians are the biggest factor in reporting. If we could get all the physicians to be active and interested and to study the problem and see the importance of reporting, it would be a great assistance.

Professor Henry R. Seager, *Chairman:* I am sure we have all listened with the greatest interest to Mr. Hoffman's stimulating and salutary paper. It is just the sort of doctrine we need as social workers to keep us alive and aware of our weakness. But I think most of us would wish to put in a caveat against his description of the manufacturer. He has had in mind the large-scale, high-minded, far-seeing employer. There are many of that type, but I think we must not forget that there are manufacturers of the other type and that the presence of such manufacturers in the community is the justification for public interference, by legislation or otherwise, to remind them that, while tariff protection is to them the all-important thing, to the community at large protection of the lives and health of their employees is even more important.

Mr. Hoffman has called attention to the paucity of literature on the subject of industrial hygiene and the difficulty of obtaining readily the literature that is available. We hope our bibliography of industrial hygiene will serve a useful purpose by giving access to this literature.

One of the achievements of this Association has been the enactment by some eight states of a law requiring the reporting of certain industrial diseases. Dr. Hatch's paper brings out very clearly the fact that in this work we have passed the stage of talking about what we ought to do and are really beginning to do things of value. I wish



"CHASER ROOM" IN WHITE-LEAD FACTORY
MECHANICAL MIXING OF DRY LEAD AND OIL

Dry White Lead Is Shovelled From the Trucks Into the Openings Under the Exhaust Pipes Which Carry Away Much of the Dangerous Dust

In One Modern Factory the Chasers Are Entirely Enclosed, Filled by Machinery Lighted by Electricity, and Inspected Through Glass Windows

to reenforce what he has said in regard to the cordial cooperation that this Association has had, in connection with its efforts to make the reporting law a success, from leading physicians in New York City. It must be admitted that, at the outset, most of the physicians we communicated with were not enthusiastic about this additional burden. But as soon as it was explained to them, their attitude changed and we have had their cordial cooperation. I hope that the plan worked out in New York State may serve as a model for the other seven states which have laws requiring the reporting of industrial diseases.

III

HEALTH PROBLEMS IN MODERN INDUSTRY

Presiding Officer: WARREN COLEMAN
Bellevue and Allied Hospitals
NEW YORK CITY

THE FUNCTION OF HOSPITALS AND CLINICS IN THE PREVENTION OF INDUSTRIAL DISEASE

RICHARD C. CABOT
Massachusetts General Hospital, Boston.

What are the hospitals doing to prevent industrial disease? Little or nothing. What ought they to be doing? Much. Why? Were hospitals organized to do preventive work and to follow back into the community all the medical problems that the community shoots into the clinics? No; the charters and constitutions of hospitals contain no distinct evidence of any such provision. But public sentiment is beginning to demand that the hospital shall advance, as the country has advanced, beyond the thought of its founders.

Public opinion is beginning to demand that hospitals and doctors alike shall do something to abolish the need of their own existence—shall make, at any rate, a sincere and strenuous effort in that direction. There are those of us who doubt the success of that effort and are inclined to believe that the prevention of industrial disease is largely a moral problem with which the hospital is not organized or temperamentally fitted to deal. But there can be no doubt that the public is putting it up to the hospitals to deal in some way with the many-spreading branches and with the single deep root of industrial disease.

Industrial diseases, such as lead poisoning and "heat cramps", pass through the hospital and out again like threads in a loom. They represent but one of many such threads of human suffering which, from the hospital point of view, suddenly appear out of the wild jungle of the modern industrial world, are visible for a moment in the cleared and lighted space which science has established in the clinic, and disappear again into the tangled outside world.

It is precisely because there are so many such threads, besides that leading to industry, that no one notices or follows up any one of them. The doctor's mind is distraught with a dim awareness, "out of the corner of his mind's eye", of this mesh of threads. He sees not only occupational diseases but recreational diseases (poi-

soned recreations) and educational maladies due, like caisson disease, to the crushing pressure of many atmospheres on sensitive minds, or to rarefication of the educational atmosphere, or to poisonous elements introduced in education. He cannot be altogether oblivious of the strands which bad housing, bad cooking, alcohol, morphine, racial misadaptation, and disillusionment weave into the many-colored fabric of misery as it passes through his clinic.

If he had been challenged only by the disgrace of industrial disease, he might have long since picked up the gauntlet and gone into the fight. But he is dimly aware that industrial disease is now in the limelight chiefly because Mr. John B. Andrews and a few other intelligent people have recognized the horror and shame that it is and are focusing public opinion upon it. He knows that poisoned recreation and poisoned education are disease-breeding factors as serious as poisoned air, and that the housing problem, the immigration problem, and the drink problem do as much as industrial risks to keep the public sick and the hospitals busy. But he also knows that he cannot fight all of the giants at once and unaided, and that to recognize them clearly and do nothing about them would render his medical right arm powerless. Hence, with a judicious instinct of self-protective adaptation, he turns his attention elsewhere.

This explains why our hospitals, though called upon to do so much, are actually doing so little to prevent industrial disease. Hospital doctors see no advantage and no heroism in biting off more than they can chew.

But the reorganization of the hospital has begun. Its forces will soon be arranged so that the doctor can call for the help he needs with some confidence that an answer will come. As soon as doctors realize this, they will begin calling for the following:

1. *Trained investigators.*—The human results of industrial disease should be followed up to their source. Was it the patient's ignorance, the employer's negligence, the law's delay, or the predisposing influence of heredity and other conditions outside the field of industry? Whenever one case of industrial disease appears at a hospital there must be many more that didn't. These others must be found.

The investigator should represent the hospital and not an outside agency, because the hospital occupies a position of judicial fairness

and impartiality. It is quite unconcerned with the special viewpoint or class consciousness of the employer or of the employed. It cannot justly incur the suspicion of either, for the hospital doesn't care a button whose fault is represented in industrial sickness.

2. *Educational weapons.*—As a result of the efforts of these investigators, excellent illustrative material will be amassed for the prosecution of campaigns of education among employers, employed, members of legislative bodies, and the general public.

The recent success of the campaign against phosphorus in industry would have been impossible if the agitation had not had some excellent pictures of the effects of phosphorus necrosis on the jaw. The hospitals are very promising fields in which to search for awful examples of this kind, and the examples will be all the more telling and persuasive if they are found by the hospitals' own agents and not by outside agencies exposed to suspicion of prejudice.

Pictures illustrating the effects of diseases and the devices for preventing them should be on the walls and screens of every clinic. They accomplish little by themselves, but if you lead a patient up to one of them and explain the picture and your advice, each by means of the other, you produce a far deeper effect on the patient's mind than you can by talk alone. A clinic thus furnished is a permanent exhibit of industrial hygiene and one likely to produce all the more effect because of its connection with the hospital. Hospitals will probably be slow to set up such exhibits by themselves, but they might be given sets of pictures on trial by an organization interested in industrial hygiene.

3. *Research in industrial hygiene.*—Such research will naturally become a part of any hospital associated with a medical school which maintains an active department of preventive medicine. It will concern the modes by which industrial disease is produced and those by which it may be prevented.

At the beginning of this article I indicated my conviction that it is the hospital's business to look into education, recreation, housing, and alcoholism as causes of disease for the same reason that it is its business to look into industry. Each of the factors just mentioned is as important as industry in causing illness and disability. In closing I wish to say that just because the hospital physician sees the interweaving and interlocking of all these factors as no one else

does, he is pointed out by the finger of common sense as the man most responsible for the difficult task of disentangling them and deciding which is dominant and most deserving of remedial effort. Tuberculosis, for example, is sometimes referred to as an industrial disease and doubtless in occasional cases it is so, but in the vast majority of cases the influence of other factors, such as nutrition, contagion, and housing, is, I believe, more important. The hospital physician, with his eye on all these factors, can take a more impartial and discriminating view of the tangled problem than anyone else. He is therefore the king-pin in the whole situation. Let us try to make him realize the honor and responsibility thus thrust upon him!

TEMPERATURE AND HUMIDITY IN FACTORIES

C.-E. A. Winslow
College of the City of New York.

Discussion of certain moot points in the theory and practice of ventilation has become so general and sometimes so disputatious that we are in danger of losing sight of the underlying facts upon which experts are in substantial agreement. Yet there is a solid basis of accepted principles and efficient methods; and this basis is amply sufficient for practical application on the part of individual factory owners, even if it is not yet so concretely defined as to be easily embodied in the form of legislative enactments.

In the first place, it is quite clear that the principal thing which makes the air of confined spaces harmful, aside from the special problems presented by dust and fumes, is overheating, especially when combined with excessive moisture. Any temperature over 70° F. puts a strain upon the heat-regulating mechanism of the body, keeps the blood in the skin away from the vital organs, and produces far-reaching impairments of the efficiency of the nervous system, the digestive system, and the body as a whole. Changes in metabolism and blood pressure, to which attention has recently been called by Dr. Gilman Thompson, are similar well-known physiological reactions to temperature change. This general effect of heat and humidity is familiar to everyone who contrasts his own ability to do either brain work or muscular work in the dog-days and in brisk autumn weather. It is established by the exhaustive studies of physiologists in Germany, in England, and in the United States; while the same studies have as yet failed to reveal any definite bad effects due to the chemical constituents of the air. Other atmospheric conditions are still in doubt. The best lower limit of temperature is uncertain. The action of hot, dry air is debatable. The physiological effect of odors in air has not been demonstrated. It is beyond question, however, that the workers in a factory where the temperature is over 70° are injured by a lowering of their vitality that may lead to tuberculosis and other serious diseases; and

that they are working below their normal standard of efficiency, so that both they and their employer are the losers.

The New York State Department of Labor is the only official body in this country, so far as I am aware, which regularly carries out examinations of factory air and publishes the results. From the reports of this department for 1908, 1909, and 1910, it appears that two hundred and fifteen workrooms were examined at seasons when the outdoor temperature was 70° or less. Of these workrooms one hundred and fifty-six, or 73 per cent, had temperatures of 73° or over and sixty-three, or 29 per cent, had temperatures of 80° or more. In a recent study of a mill village carried out by the Rhode Island Anti-Tuberculosis Society, temperature and humidity readings were taken three times a day inside and outside of a weaving room. The outdoor temperature for the month (September) averaged 65.5°. The temperature in the weaving room averaged 75.8°, 10° higher. Is it not clear that, aside from all debatable questions, there is a simple and obvious condition here which directly menaces the health of the workers and impairs the efficiency of industry?

The first clear problem of air conditioning in the factory is the prevention of overheating. The practical method of attaining this end is air change or ventilation. With only a few people in a room, heat may be transferred through cracks and through the substance of walls and ceiling with sufficient rapidity, without any special provision for the purpose. Where many workers are crowded together, however, this is impossible. The average human being at work produces about two hundred and fifty calories of heat per hour, equivalent to the heat liberated by the burning of two candles. In many factories this heating effect is supplemented by the friction of machinery and the combustion of illuminants, and often by furnaces, mangles, steam jackets, pressing irons, solder pots, and other direct sources of heat. The most convenient method of removing this excess heat is by air change; and the primary need in factory ventilation is to provide for the removal of the heated air and its replacement by cooler air from without. The latter must usually be first tempered by raising it to a point a little below that which is normally felt to be comfortable. Whatever may be the case in hospitals and schools, it is fairly certain that incoming air much below 60° would not be

endured by factory operatives; and it would certainly not be compatible with efficiency in the majority of trades which call for manual dexterity.

I am speaking in this connection of the maintenance of ordinary normal atmospheric conditions in the factory. The possibility of occasional variations from this normal is a separate question. It is maintained by many sanitarians that changes in temperature are stimulating and beneficial. There is little exact evidence for this view, but it is in harmony with general experience and is probably correct. In many schools it is the practice to open windows and flush out the room with cold air every two hours or so, and the effect upon the spirit and efficiency of the pupils is said to be excellent. Such a procedure might be well worth the temporary interruption of work in many industrial processes. It is merely a modification of a general system of air conditioning, however, not a separate system by itself. The fundamental problem is the exhaustion of the hot air of the workroom and the supply of cool but tempered air to take its place. I shall not dwell upon the methods by which this end can be attained, since they differ in each individual case. In general, I believe the hot air should be taken out near the top of the room and the cool air admitted near the bottom. The hot air may escape by its own tendency to rise or may be sucked out by fans. The cool air may be admitted at window openings in the room, equipped with tempering coils; or it may be forced from a central point through special ducts. The system of ventilation may or may not be supplemented by a direct system of heating. The essential principle remains unchanged.

When we pass, however, to the question of embodying desirable conditions in statutory form, which is the primary object of your Association, the matter is not so simple. At present there are only two types of laws on the statute books of American states, with the exception of the 1909 law of Illinois. Eight or ten states provide for a minimum cubic space per occupant, usually two hundred and fifty or four hundred cubic feet. Some twenty states require that factories shall be "ventilated" or "well ventilated" or "sufficiently ventilated". The cubic space requirement by no means insures good air conditions. It merely prohibits such a state of overcrowding that proper air conditions are im-

possible. Whether a factory with ample air space is comfortable or not depends on the further provision for air change. In the studies made by the English departmental committees it was found that the air was no better on the average in factories with over five thousand cubic feet of air space per occupant than in those with an air space under three hundred cubic feet. As to the provisions that factories must be "ventilated" or "well ventilated", they are unenforceable and meaningless in the hands of the present departments charged with factory inspection in this country. The Illinois law is the only real ventilation law in the United States. It provides that a definite amount of air, 1500 to 1800 cubic feet per occupant, according to specified conditions, shall be supplied, unless the cubic space in the workroom be over 2000 cubic feet per occupant and the outside window and door space be equal to one-eighth of the floor space.

In formulating a standard for factory ventilation one is met at the outset by the question whether the standard should be a mechanical or an analytical one. Ventilating engineers prefer to have the amount of air supply fixed as in the Illinois law. Sanitarians argue that the proper standard is the actual condition maintained in the workroom, however it may be reached. In a proposed law drafted in conference with members of this Association in New York a year ago and introduced in the state legislature as Senate Bill No. 1019, on March 31, 1911, an attempt was made to combine these two viewpoints on an alternative basis. This bill provided that "a workroom shall be deemed to be properly and sufficiently ventilated if the air in the working parts thereof does not contain more than nine parts of carbon dioxid in 10,000 volumes of air in excess of the number of parts of carbon dioxid in 10,000 volumes of the exterior air, or if there is constantly supplied throughout the interior of the room at least 1200 cubic feet of air per hour for each person therein present and employed and in addition thereto at least 1000 cubic feet of air per hour for each cubic foot of gas burned per hour". Such a law, which demands a reasonable rate of air change, to be demonstrated either by analysis or on a mechanical basis, seems eminently fair to the manufacturer and probably safeguards sufficiently the health of the worker so far as the extent of air change is concerned.

Any ventilation standard must, however, deal with the quality as

well as with the quantity of the air. The most important things are the temperature and humidity of the air. These qualities are measured very simply by the use of an instrument known as the sling-psychrometer, which consists of a pair of thermometers, one of the ordinary type and the other having its bulb covered by a wet cloth. Moisture evaporates from the wet cloth at a rate determined by the amount of moisture in the air and this evaporation cools the wet-bulb thermometer and lowers the temperature recorded. From the temperature of the dry-bulb thermometer and the difference between the dry and wet bulb, the moisture in the air may be readily calculated. A high wet-bulb reading means a combination of temperature and humidity, precisely the condition most harmful to the human organism, and Haldane has shown that in general a given wet-bulb reading has about the same physiological effect, whether it be the result of a very high temperature with low humidity or of a moderately high temperature combined with high humidity. The proposed New York law, to which reference has been made, provided that "the temperature in any factory workroom except a boiler room, shall not exceed 72° F. as determined by the wet-bulb thermometer, unless the temperature of the exterior air exceeds 70° F. as determined by the same process, in which case the wet-bulb temperature shall not exceed that of the exterior air by more than 5°." A wet-bulb temperature of 72° would correspond to a dry-bulb temperature ranging from 72° with completely saturated air to 93° with air containing only 30 per cent relative humidity.

It is just here that the difficulty comes in formulating a standard for factory ventilation. Either the Illinois law or the proposed New York law would serve pretty well to regulate the amount of air to be supplied. I do not believe, however, that we have adequate data for fixing a maximum figure for temperature and humidity. The limit of 72° wet bulb written into the proposed New York law was taken as a maximum which would probably not be onerous to the manufacturer, but it is possible that even this limit might be difficult of attainment in certain industries, while in most factories it is probable that a much more stringent regulation could well be adopted. Industrial processes are very diverse and any rigid statutory standard is likely to work hardship on the one hand and to give inadequate protection to the worker on the other. As Socrates long ago taught his ardent pupil Glauco in the *Mem-*

crabilia, it is no light matter to make laws governing industrial conditions. Standards for factories can only be wisely formulated after a careful study of existing conditions in the light of physiological ideals and by striking a fair balance between what we should like and what the factory owner can reasonably provide. In our own homes we maintain, not a wet-bulb maximum of 72°, but a dry-bulb maximum of 70°, a very different thing. How near this desirable ideal the legal limit should be placed can only be determined by a careful study of present conditions and practical possibilities in specific trades.

The old English law governing conditions in cotton-weaving sheds provided that in sheds in which there was artificial humidification the limit for carbon dioxid should be nine parts per 10,000, and fixed a definite relation between wet and dry-bulb temperatures for each dry-bulb temperature over a wide range, but set practically no upper limit for either. With the advance of modern ideas as to the supreme importance of temperature in air conditioning the whole question was reopened by the creation of a departmental committee which heard ninety-six witnesses, including physiologists, factory inspectors, mill owners and operatives, made seventy-six inspections and numerous air examinations, published the results in two hundred and fifty closely printed pages and formulated a new standard raising the carbon dioxid limit to eight parts in excess of that in the outside air and adding a temperature limit of 75° wet bulb. All this was done for one branch of one industry; precisely this sort of investigation is urgently needed in the United States.

In view of the difficulty of formulating legal standards, Wisconsin has adopted an entirely different plan, abandoning entirely the attempt to fix the details of factory regulation in the form of law and creating instead an industrial commission with power to fix specific standards whose reasonableness can be reviewed only by the supreme court of the state. The regulations of such a commission could be made far more responsive to the varied and changing conditions of science and industry, and would offer the most promising method of securing a maximum of protection for the worker with a minimum burden on the business itself.

It is quite as essential, however, for the work of such a commission as for the formulation of specific laws, if that method of pro-

cedure be preferred, that a thorough study of existing factory conditions by properly qualified experts should be made. There have recently been valuable studies of certain industrial poisonings in this country, notably by the Illinois Commission on Occupational Diseases and by Dr. Andrews, the secretary of this Association. General sanitary conditions, and particularly air conditioning, are far more important in the aggregate than these specific poisonings. The latter are obvious and spectacular, but they only affect a comparatively small fraction of the working class. Even in the pottery industry, one of the trades most subject to lead poisoning, it was shown in England by the departmental committee on this industry that the excess death rate due to plumbism was only .8 per 1000 while the excess death rate due to tuberculosis was 7.0. Industrial tuberculosis pervades not only the dusty trades, but in less degree every industry from the largest to the smallest. Yet as to air conditioning in our factories we know pitiably nothing and we have no machinery for finding out anything. New York has a good medical and laboratory expert in Dr. Graham-Rogers. Illinois has recently appointed a medical expert from whom we are to hear to-morrow. Massachusetts has a force of fifteen medical inspectors devoting some or all of their time to the work. This is all that we have in the way of scientific factory inspection in the whole United States. For progress in air conditioning it is essential to have air examinations and intelligent inspection of ventilating appliances in factories of various types. Only on the basis of such studies can legal standards be enacted or specific rules laid down by a factory commission. Yet we have in the whole United States, except for Dr. Graham-Rogers in New York, not one single chemist or engineer regularly employed by any state to study factory air conditioning.

Would it not be well for this Association to take up seriously at this time the problem of expert organization of the state bureaus which are supposed to deal with industrial hygiene and sanitation? It is less standards that we need than experts to formulate new standards and enforce the old ones. There should be medical experts and chemical experts and engineering experts,—not just doctors and engineers, but doctors and engineers who have specialized in public health,—on the staff of the body which enforces health laws in factories in every large industrial state; and we shall not get much farther with the problems on hand until this comes to pass.

Meanwhile, however, there is an excellent opportunity for the individual factory owner to benefit his employees and increase their output by attention to the problem of air conditioning as regards temperature and humidity. There should be a thermometer in every workroom and the foreman should be made to understand that every time the temperature passes 70° he is failing to secure the best work from his hands. In any large factory, observations of ordinary temperatures should be supplemented by the use of the sling-psychrometer. Only by such observations can window ventilation in small shops and ventilation systems in large factories be intelligently controlled. Direct practical results in diminishing absences and decreasing damaged and imperfect work have been obtained in many a factory by improved air conditioning. Efficiency methods have been applied to a hundred mechanical details of shop administration. That delicate mechanism the human body is, however, the underlying factor which is after all of most importance. Yet in many a workshop, perhaps in most workshops, the human body is being operated under conditions which preclude its maximum effectiveness, and the work suffers while the sanitariums fill up with cases of industrial tuberculosis.

AIR IMPURITIES—DUSTS, FUMES, AND GASES

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The nature and extent of air impurities discussed in this paper are dependent upon local conditions. For our purposes these air impurities may be classified under three heads: namely, (1) dusts, (2) fumes, and (3) gases. These divisions are not exclusive, as fumes in abundance may become dusts; for example, a sudden escape of white arsenic fumes results in a cloud of dust. Again, smelter fumes (mainly sulfur dioxid), much diluted, may be classed as gaseous. The classification, therefore, is neither specific nor dependent upon inherent properties of the materials. It is merely a convenience and must admit of a broad and liberal interpretation. A technical discussion as to proper lines of differentiation would be of little profit and less interest.

INDUSTRIAL DUSTS

It is well known that various industrial dusts cause irritation of the respiratory passages and of the eyes and skin of workmen. Such dusts may be considered in three classes: namely,—

1. *Insoluble inorganic dusts.*—This class includes metals (antimony, arsenic, type-metal, brass, bronze, copper, aluminum, iron, steel, lead, manganese, vanadium and ferro-vanadium, silver, tin, zinc, and solder) in a state of fine division (dusts, atomized metals, metallic powders); flue dusts; various ore dusts (iron ore, etc.); silica, sand, emery, flint, glass powder; carbon, graphite, diamond, coal, soot; brick dust, marble, granite, cement, terra-cotta; lime, gypsum, plaster, meerschaum; phosphates, guano, etc.

Fibrosis of the lungs may result from the inhalation of silicious or metallic particles; for example, we have "potter's asthma" and "grinder's phthisis" (chronic catarrhal bronchitis among knife-grinders). Pneumonia has been reported as frequent among workmen in blast-furnaces, in part owing, directly or indirectly, to the

inhalation of slag dust; cardiac dilation is said to occur among workmen in slate quarries; ankylostomiasis among brickmakers, miners, etc.; and recurrent inflammation of bone with hypertrophy among pearl-dust workers.

Hellthaler[1] has shown the high rate of death among various classes of metal workers in America who are apparently in ignorance of the peculiar dangers of their occupations; and Prinzing[2] has demonstrated the high death rate from phthisis among steel grinders and other workmen at Solingen, Germany, for the years 1885 to 1895. It is certain that the inhalation of iron dust may diminish in time the respiratory efficiency of the lungs through a loss in their elastic property; or may reduce the resistance of the organs to invasion by harmful bacteria; or may infect the lungs through a transportation of disease germs to places favorable for their inoculation. The disease known as siderosis exists commonly among metal polishers, knife-grinders, and others engaged in metal working. The earliest symptoms of this disease are, according to Soper,[3] catarrh and bronchitis, but shortness of breath is pronounced by all authorities to be the most characteristic symptom. Eventually there follows what appears to be phthisis without the presence of tubercle bacilli, yet genuine infective phthisis is the most common cause of death. The effects may be delayed for years, but metal working is indeed a dangerous occupation; undoubtedly many die from infectious pulmonary diseases who do not know that the breathing of dusty air has led to their infection.

With the development of rapid transit systems in modern cities, it may be well to direct attention to a new and specific form of city dust investigated by Dr. Soper,[4] who found that the average weight of dust in subway air was 61.6 mg. per 1,000 cubic feet of air, or 2.25 mg. per cubic meter. The figures for the streets were 1.83 mg. per cubic meter. The subway dust was found to consist chiefly of angular particles of iron, but no case of siderosis seemed to have been reported.

2. *Soluble inorganic dusts.*—This class comprises such substances

[1] Hellthaler, "The Death Claims." *The Independent,* December 27, 1906, v. 61:1560.

[2] Prinzing, *Handbuch der Medizinischen Statistik,* 1906, p. 489.

[3] Soper, *The Air and Ventilation of Subways,* 1908, p. 205.

[4] *Ibid.,* p. 200.

as are likely to be swallowed and absorbed, and includes: metal particles (lead, brass, copper, zinc, arsenic, mercury, and silver) and soluble inorganic salts. Many dusts of this class are dangerous, not only because of their irritating or poisonous properties, but also because of their inflammability,—e. g., potassium chlorate.

3. *Organic dusts.*—This class comprises sawdust, fur, skins, feathers, broom and straw, grain and flour, jute, flax, hemp, cotton, wool, carpet dust, street sweepings, tobacco and tobacco-box dust, hides and leather, felts, rags, paper, horsehair, etc.

As representative diseases caused by organic dusts we have: "flax-dresser's disease", a kind of pneumonia due to the inhalation of particles of flax; pneumokoniosis due to the inhalation of dust by gannister workers; alkaloidal poisoning from African boxwood by workmen engaged in shuttle making; and malignant pustule and a febrile disease among rag-sorters. As in the other classes, the components of this class of dusts are all irritating to the respiratory tract and to the eyes, and especially are they capable of forming inflammable, and even explosive mixtures with air. In addition, there are various trade eczemas, and anthrax has been frequently reported among wool-sorters.

The solution of the industrial dust problem presents many difficulties. Undoubtedly, however, disease from dust may be much reduced by the following procedures:

(a) Those engaged in the following occupations should wear "workmen-respirators": sorting rags in paper factories; workmen on threshing machines; millers; batch-mixers in glass factories; stone-cutters and sculptors; and all those working in factories where the air is contaminated with irritating or poisonous dust.

(b) Those employed in the manufacture of oxidizing agents and lead workers should be compelled to change their clothes before leaving the factory. This is done now in some works in this country.

(c) Glasses for the protection of the eyes of workmen should be looked upon as necessary in plants where irritating dusts are unavoidable.

(d) The dust on the floors of printing, type-casting, metal-working, and other establishments may be laid by means of certain useful preparations. Heise[5] considers those consisting entirely of non-drying (mineral) oils to be the best for the purpose.

[5] Heise, *Arb. Kais. Gesundh.—Amt,* 1909, v. 30: 93.

Where vapors are likely to occasion industrial poisoning, ventilation will serve to prevent their accumulation; but in the case of dusts, economic considerations often render such a procedure difficult except, of course, as the maintenance of normal ventilation assists in their elimination.

NOXIOUS FUMES, GASES, AND VAPORS

The air of cities and towns where chemical manufactories exist is often contaminated with noxious gases of industrial origin which are dangerous to the health of the workmen employed in the industries. The usual gases which give rise to complaint in manufacturing localities are the following: chlorin, which is emitted by pottery kilns and ceramic-products manufactories, and from plants for the electrolysis of halides; hydrogen chlorid, which is produced by the combustion of coal, and by pottery kilns, ceramic-products manufactories (partly from the coal and partly from the clay), nickel and cobalt smelting, platinum refining, glass manufactories, fertilizer manufactories, the chlorid of lime industry, and alkali manufactories; sulfur dioxid and sulfuric acid, which result from the combustion of coal, coke, petroleum, and gas, copper smelting, bleaching operations, etc.; fluorides and hydrofluoric acid, which are emitted from acid phosphate and heavy chemical plants; hydrogen sulfid, from chemical works, especially those which produce ammonia; carbon monoxid, which is emitted from iron furnaces and from copper smelters; organic vapors, from, for example, glue refineries, bone burners, slaughter and packing houses; zinc fumes from zinc smelters and from brass foundries; arsenical fumes from copper smelters; phosphoric fumes from match manufactories; and carbon disulfid and sulfur chlorid from some rubber works.

Lehmann[6] compiled the accompanying table from the reports of many investigators, to show at what concentrations the various common industrial gases are capable of producing immediate and observable effects upon health. The destructive action of fumes in the vicinity of chemical plants is generally due, however, to the presence of sulfurous acid, sulfuric acid, or hydrochloric acid; and this table is given on account of the occupational hazards on the part of workmen employed in chemical manufactories and smelters.

[6] Lehmann, *Methoden der Praktisch en Hygiene*, 1901, p. 174.

NAME OF GAS		Rapid and dangerous injury	Bearable for 30 to 60 min. without grave effects	Trifling symptoms after action for some hours
Hydrochloric acid....	per 1000	1.5—2	0.05	0.01
Sulfurous acid	" 1000	0.4—5	0.05	———
Carbonic acid	" 1000	About 30	6 to 8	1 to 2
Ammonia	" 1000	2.5—4.5	0.3	0.1
Chlorin; Bromin.....	" 1000	0.04—0.06	0.004	0.001
Iodine	" 1000	———	0.003	0.005—0.001
Hydrogen sulfid	" 1000	0.5—0.7	0.2—0.3	0.1—0.15
Carbon disulfid	" 1000	0.01	0.002	0.001
Carbon monoxid	" 1000	2 to 3	0.5—1.0	0.2

Of the gases which affect the respiratory passages and eyes the most important are the following: illuminating gas, gases from coke and coal; carbon monoxid; carbon dioxid (in brewing, baking, and the manufacture of aerated waters); chromic acid; chlorin; sulfuric, hydrochloric and nitric acids, and nitrogen oxids (in acid factories, heavy chemical works, engraving, etching, lithographing, etc.); mercury cyanid; heated lead; ammonia; naphtha and benzine (petroleum refineries and dry-cleaning establishments); arseniuretted hydrogen (copper refineries); sulfur, hydrogen sulfid, sulfur dioxid, and carbon disulfid, sulfur chlorid, nitrous gases, hydrocyanic acid; smoke (fire extinguishing); and the vapors of various organic compounds and substances (tar, creosote, carbolic acid, petroleum and its products, methyl alcohol, fusel-oil, varnish solvents, dinitrobenzol, nitroglycerine, formaldehyde and formic acid, pyridin, etc.). In addition to irritating the respiratory tract and eyes, such substances as the halogens, mineral acids, formic acid, alkalies, creosote and carbolic acid, various dyes, etc., cause injuries to the skin, giving rise to burns, eczema, fissures, ulcers, etc. It has been said that workmen in by-product coke plants, coal-tar color works, and in the roofing and paving industries are troubled with epitheliomatous cancer or ulceration of the skin or of the corneal surface of the eye, owing to constant exposure to pitch and tar compounds; that workers with chromates, tanners, and dyers have "chrome ulceration" of the skin; and that there are various trade eczemas, often of a troublesome nature.

Virtually no accidents have been recorded with hydrogen chlorid gas, and accidents with hydrocyanic acid gas and arseniuretted

hydrogen are not of frequent occurrence in American plants. Carbon monoxid occurs in colliery workings after explosions, in gas producers, blast-furnace gases, and in the manufacture of calcium carbid and phosphorus; hydrogen sulfid occurs in gas-liquor storage tanks, gas purifiers, sulfate stills and saturators, and in sewers; chlorin is found in and about bleaching-powder chambers, manganese stills, and Deacon and other chlorid plants; and nitrous and nitric acid fumes, which are very insidious in their action, are met with in vitriol chambers, especially in Gay-Lussac towers, during repacking and cleaning, in the manufacture of nitrate of iron and nitric acid, and in all breakages of vessels containing nitric acid.

The prevention of accidents and diseases among workmen in chemical and metallurgical plants is a subject which has received much consideration in England and Germany. From the experience in those countries we may conclude that the following preventive measures may be taken:—

1. In petroleum refineries, extraction rooms, ether manufactories, plants where inflammable liquids and vapors are likely to be present in the air, flour mills, and all other mills where inflammable dusts are likely to be wafted about or suspended in the air, the belts on all machinery should be treated with a suitable compound to prevent or minimize the possibility of static discharges. The other measures necessary for minimizing the fire risks are well known.

2. Workmen in plants wherein the air is contaminated with halogen, mineral acid, metal or other irritating vapor, should be required to wear "workmen-respirators".

3. Instructions should be given as to the use of oxygen and the methods of effecting artificial respiration. A very good description of such procedures is given in the *Chemical Trade Journal,* 1896, v. 19: 260.

4. Glasses for the protection of the eyes of workmen should be required in plants where acids or caustic liquids are used or made.

5. The plants should be well ventilated, in order to prevent the accumulation of gases and vapors.

A number of safety devices have been invented in Europe for workmen in chemical plants, and many of them have been found to be of great value. These cannot be considered here. It has also been statistically shown that a great many of the accidents in chemical plants happen on Mondays.

While we have not given as much attention in this country as we might to the subject of dusts, fumes, and gases in industrial establishments, the writer knows of earnest efforts on the part of certain large corporations to provide every precaution. One of the most difficult phases of the problem here is to secure the cooperation of the non-English speaking laborers. The American's appraisal of the value of a Dago's life, however, is associated not only with questions of financial economy, but also with the problem of how best to preserve the economic efficiency (health) of the individual. Prevention, reduction, and recovery are, therefore, of great importance as public health problems. Legislation is needed, but laws do not either enact or execute themselves and we must have sufficient appropriations for the determination of facts and the enlightenment of the public mind as to the effects of noxious industrial emanations.

EFFECTS OF CONFINED AIR UPON THE HEALTH OF WORKERS

GEORGE M. PRICE
New York State Factory Investigating Commission.

The air conditions in industrial establishments, which have an effect upon the health of the workers, may be classified in three divisions: (1) extreme variations in pressure, humidity and temperature; (2) dusts, poisons, gases, fumes, and infective bacteria; and (3) ordinary confined air. Of these three divisions the first two may be regarded as accidental to industries. The third division, ordinary confined air, is practically incidental to all indoor industries. The relative number of industries in which there is considerable variation in pressure, humidity, and temperature, or in which there is considerable danger from dust, poisons, gases, and fumes, is small in comparison with the industries in the establishments of which confined air prevails.

By the term "confined air" is meant air which is confined and vitiated by many impurities due to respiration, combustion, illumination, and overcrowding. In an examination of 4,850 establishments in New York State no means of ventilation, except by windows, was found in 88 per cent of the shops. The air in all these shops was confined and vitiated.

There is as yet a difference of opinion as to the exact nature of the toxicity of confined air. There is, however, no difference of opinion as to the dangers to health of a continuous and constant inhalation of such air.

It is not difficult to study the effects of extreme variations of pressure, temperature, and humidity of the air upon the health of workers in factories. Nor is it very difficult to trace the effects of specific poisons, gases, or fumes in the air, or to study the results of constant inhalation of certain kinds of dusts. The etiological relations between the accidental air impurities and the health of workers may be studied experimentally as well as clinically. The pathological lesions produced by most of these accidental impurities

are distinct and certain, and the diseases produced by them are either acute or chronic.

Not so with the effect of ordinary air impurities, which are understood by the term "confined air". The effects of confined air are less distinct, more difficult to prove, less direct, and more insidious, although not less deadly. Mortality statistics show that the death rate of workers in indoor occupations is much higher than that of workers in outdoor occupations. There is no doubt that the chief cause of this higher rate of mortality among indoor workers is the confined air of shops and factories. Aside from this, however, we have hardly any evidence in mortality statistics as to the effects of confined air upon workers. Confined air does not produce distinct pathological lesions, nor does it directly cause any diseased conditions; and therefore its influence on the death rate is difficult to prove. The best method for studying the effects of confined air upon the health of workers is to study the comparative morbidity rates of workers in different occupations who habitually breathe stale air in the course of their several employments.

The effects of constant and continuous inhalation by workers of the vitiated atmosphere of shop or factory will undoubtedly manifest themselves upon the general health of the workers, but more immediately and directly in the organs of respiration and digestion. Lassitude, fatigue, headaches, anorexia, anemia, indigestion, defective oxygenation, lack of vital resistance, and a predisposition to catarrhal affections of the air passages, are the inevitable results of a chronic intoxication by vitiated air.

The diseases, therefore, which we would expect to find among workers in vitiated atmospheres are bronchitis, anemia, and indigestion. Pulmonary tuberculosis and diseases of metabolism would probably be the sequelae.

In the effort to determine the effects of confined air upon workers it would be valuable to have a comparative table of the prevalence of anemia, bronchitis, and digestive diseases among workers in various indoor occupations. Unfortunately such data are unavailable in this country. The only way by which the facts may be gathered is by a physical examination of a large number of workers in different trades. It has, therefore, occurred to me that it may be of value to present some results of a physical examination of workers in

two different industries, which it was my privilege to conduct during the last year.

The medical examination of eight hundred bakers was made during last October by the New York State Factory Investigating Commission. The medical examination of six hundred cloak and suit makers was made by the Joint Board of Sanitary Control in the Cloak, Suit and Skirt Industry during the month of March. The bakers examined were those found in cellar bakeries in New York City; the tailors examined were those found in some of the best shops in the same city. We have also examined six hundred tailors in the worst shops in the East Side of New York City, but data for these are still unavailable. The accompanying table is very incomplete and no classification has been made according to age and sex.

The nativity and personnel of the bakers and tailors examined differed very little; their hours of labor were but slightly different though somewhat to the advantage of the tailors; night work is, of course, customary in bread making although a negligible factor in tailoring.

Dust was found in bakeries as well as in tailor shops. With the present methods of baking, however, the effect of the flour dust is unimportant as very little is allowed to escape. The vegetable and animal dust found in cloak shops was not sufficient in quantity to cause serious injuries. In the bakeries the temperatures near the ovens were rather high, but this affected only a comparatively small number of workers. The amount of CO_2 in bakeries and cloak shops does not differ very much. According to Dr. C. T. Graham-Rogers, who has made examinations in the shops of both industries, the amount of CO_2 in the air ranges from 6 to 25 per 10,000 volumes, and does not differ very much in the two industries.

The sanitary conditions of the cloak shops in which workers have been examined were exceptionally good, as these belonged to certificated shops in the industry. All the cloak shops examined were ventilated, however, by means of ordinary windows and, although not overcrowded, the ventilation of all the rooms was defective because the windows were closed and no special provision was made for introducing fresh air. The bakeries examined were all underground with no provision for ventilation except through small windows or gratings, but owing to the heated ovens the change of air was probably not less than in the tailor shops.

RESULTS OF THE PHYSICAL EXAMINATION OF 1413 WORKERS IN CELLAR BAKERIES AND IN SOME OF THE BEST TAILOR SHOPS IN NEW YORK CITY

	Bakers		Tailors	
	No.	Per cent	No.	Per cent
Total examined	800	100.0	613	100.0
Free from disease	347	43.4	115	18.8
Had the following diseases:				
Anemia	183	22.9	158[1]	25.8
Asthma	21	2.6	9[2]	1.5
Bronchitis { Acute	177	22.1	19[3]	3.1
Bronchitis { Chronic			36[4]	5.9
Laryngitis			5[5]	0.8
Pleurisy	2	0.3	4[6]	0.7
Tuberculosis { Positive	19	2.4	4	0.7
Tuberculosis { Suspected			7[7]	1.2
Diseases of the digestive system	76	9.5	186	30.3

[1] Of the 158 who had anemia only 31 had no other disease; of the 186 who had diseases of the digestive system only 36 had no other disease; the others had one, or more than one, other disease.

[2] Five of these had chronic bronchitis and are included in that list.

[3] One of these had tonsilitis and is included under diseases of the digestive system.

[4] One of these had pharyngitis and is included under diseases of the digestive system.

[5] One of these had chronic bronchitis and is included in that list.

[6] Two of these had chronic bronchitis and are included in that list.

[7] All of these had chronic bronchitis and are included in that list.

Total number of diseases among the tailors, about 950.
Total number of tailors, 613.
Ratio of diseases to tailors, 15.5:10.

We have no statistics in this country with which to compare the results obtained by our physical examination. We thus have no standard by which to judge the variations in the morbidity rate. Nor can a comparison be made with the morbidity statistics of Sommerfeld and others gathered from the German sick funds (*Krankenkassen*), for the reason that these morbidity rates are given mostly for those members of the sick-fund societies who are unable to work. Dr. Sidney I. Schwab's figures of the prevalence of neurasthenia among tailors,[8] and Dr. Waters' claim of the large percentage of tuberculosis among tailors, may be referred to here as the only figures available on the morbidity of tailors.

The standard mentioned by Hoffman of the incidence of 15.5 diseases to ten persons, being the German rate, can be compared to the 950 diseases for the 613 tailors examined, which makes a ratio of 15.5 to 10.

The large number of bakers suffering from bronchitis, in comparison with the number of tailors suffering from that disease, seems to indicate the better sanitary conditions of the tailor shops, which, as has been noted above, belong to those that have received sanitary certificates from the Joint Board of Sanitary Control. On the other hand, the comparatively large number of digestive diseases among tailors may perhaps be due to their stooping posture and to their lesser muscular activity as compared with bakers, who are always on their feet and who change the character of their work a number of times during the day, while tailors sit at a machine for nine hours a day with only a single interval for relaxation.

It seems to me that the comparatively high percentage of anemia, bronchitis, and digestive diseases noted among both the bakers and the tailors is at least suggestive of the defective ventilation of the shops in these industries, and that the confined air which bakers and tailors are compelled to breathe habitually has a strong etiological relation to these diseases. Much more intensive and extensive study of the subject is necessary, however, before the relation of confined air to the health of the workers can be definitely determined.

[8] Publication No. 12, American Association for Labor Legislation.

GENERAL DISCUSSION

MR. J. T. AINSLIE WALKER, *New York City:* I have listened with great interest to the papers read this afternoon. Speaking as an Englishman, having been in this country but a few months, there is one phase of this problem which you do not consider as fully as I had hoped. We have heard of the precautions to secure proper ventilation, but the last speaker has dashed our hopes by stating that in many instances among tailors and bakers confined air is almost essential. To consider ventilation alone is not enough; we must deal with the presence of dust on all workroom floors. This problem has received attention at home and I hope soon to see it properly handled in this country. I know of no finer institution to take up such work than this Association.

I think we all agree, also, that if this problem is to receive proper attention we must have the assistance of the manufacturers. There is no use in trying to force them to do what we want, but we must try to persuade them. If the moral argument is not sufficient, the best inducement is the one that appeals to the pocketbook. The best that a man can do in a day is one hundred units of work. Suppose a manufacturer is employing one hundred workmen. If you represent to him that, by neglecting certain precautions which you can show him how to handle successfully and economically, the loss of work and fall in efficiency is ten per cent, you have a direct argument to place before him. He sees that among one hundred workers a lowering of ten per cent in efficiency means that he is losing the work of ten able-bodied men every day. If this argument is put before the American manufacturer, as it has been successfully put before the English manufacturer, I think he will listen to you. You are more likely to achieve success this way than if you appeal from a moral point of view.

A year or two ago an English doctor, bearing the famous name of Lister, called attention to the high death rate among printers. The attention of the federation of printers and allied trades was called to it by myself, and they decided to investigate the question first-hand. A certain area of floor space in one of the largest establishments in London was chalked off. One-half was sprinkled with a disinfection solution; the other half was sprinkled with

water. Swabs were taken over each of these spaces and the contents examined. On the plate which was from the section sprinkled with water only there were crowds of bacteria; the other plate showed no colony of bacteria. Thus the disinfection was shown to be satisfactory. The publication of this result in the textile papers and trade journals had a marked effect on the minds of manufacturers in England.

MR. MEHREN, *New York City:* We are engaged in efficiency engineering work, the improvement of factory conditions in order that the output may be the maximum and that the manufacturer may have the least possible cost and the worker the highest wage. From that standpoint the efficiency of the men is a very important consideration. We go to the manufacturer and say, "Betterment works of all sorts are not philanthropies; they are profitable investments." We have not gone into chemical factories and consequently much said this morning about the lead industry went over my head, but we have been able to make valuable use of efficiency tests. We found a short time ago a large establishment with fifteen hundred employees in which the manufacturers knew they had not full efficiency, although they had not been able to put their finger on the cause. We found that the ventilation was bad and that the common drinking cup had propagated colds in winter. Why not call in to aid the campaign for industrial hygiene the efficiency engineer, who is directly studying factory conditions with the idea of improving them? Legislation, strict enforcement of law, will produce much good. But the greatest result will be accomplished when you take advantage of all possible methods, one of which is to enlist the cooperation of the consultant in the engineering world.

DR. LEONARD W. HATCH, *New York Department of Labor:* This point has come to my attention as bearing out what was said of the value to the manufacturer of medical care of his employees. A certain small New York plant employing two hundred and fifty people is quite a model establishment so far as ventilation goes. The firm established a benefit system and in connection with that a plan for giving the employees medical attention. It was arranged that a physician, employed by the firm, should be at the plant every day at five o'clock, and anyone who was employed there could con-

sult the physician by making his desire known to the watchman or porter. At five o'clock all who could be attended to that day were notified by the watchman. After a year's experience the head of the firm stated that, though they had never kept records of the time lost in previous years, he was sure that, even in that period, without any special hazards, they had saved enough of the workers' time to more than pay the cost.

Mr. Paul Kennaday, *Secretary, New York Association for Labor Legislation, New York City:* We have heard that it pays to keep the workmen well. In this Association we want to take the view that it is *just* to keep the workmen well. We should go to the labor unions, get out on the stump, use the newspapers, and teach the industrial population that they should keep themselves well for their own benefit and not to increase any dividends. And then, having aroused that feeling among them and a certain amount of enthusiasm, we should get after our state labor departments and get them to do their duty. Many are doing excellent work and many are not doing anything at all. They should make investigations into continuous processes, and give us the facts in regard to the number of men who are working seven days a week and the effect of such work on their health. At present we have no such facts. As one member of the Association I say, let us emphasize a little more strongly the fact that it is justice we are after and not the payment of higher dividends.

Dr. Lee K. Frankel, *New York City:* I have been reminded of an old story about barking dogs that never bite. I suppose you know the story of the man who was running away from a dog. His friends told him, "Barking dogs never bite." But the man replied, "You know it and I know it, but the dog doesn't know it."

The discussion here has centered largely around what might be done in the direction of preventing disease through efficient legislation and by the employer of labor, but nothing has been said about what can be done by the workman toward safeguarding his own health. I want to mention what has been done in the city of Vienna, where there is a federation of sick clubs, under the Austrian government, which records every disease that occurs among its members, and these clubs practically comprise every workman earning a cer-

tain income. Every member realizes that it is for his distinct advantage to report the conditions that exist in the factory where he works, particularly with reference to accidents. The result is that in the central bureau there is a careful record of every industrial establishment in the city of Vienna reported under the very best form of factory inspection known, namely by the employee himself, and by moral suasion without the necessity of legislation. These clubs have gone to the employer who has not introduced proper safeguards against accidents, or who has not put his mill or factory in good sanitary order, and have shown him that his establishment is below the standard, or proved to him that more accidents occur in his establishment than in those of his competitors. By this method they have been able to raise the standard exceedingly. Lacking compulsory industrial insurance it seems to me that, if this problem were taken up by our labor organizations, they could institute a system similar to that in vogue in Vienna and bring home to their employers the need for putting their factories in proper condition.

Mr. Miles M. Dawson, *New York City:* There is no question in my mind but that wherever there is a system of insurance, contributed to by both employer and employee, in addition to the collection of reliable information, there is the further result that attention is given to the subject by both sides. The benefits of sickness insurance in guarding the health of employees in Germany are doubtless great. This has reference quite as much to accidents as to illness. It is, therefore, unfortunate that so far, during the brief development we have had of workmen's compensation in this country, there has been no extension of such insurance. We would not only have done better work in connection with workmen's compensation, but would have indirectly had means of determining what the facts are concerning industrial diseases and industrial accidents, if we had adopted the plan in force in many countries of sickness insurance societies.

Mr. John Martin, *New York City:* Professor Winslow said, and so far as I have been able to read the literature on the subject it seems to be agreed, that practically the only factor in ventilation about which we are positive is that overheating is detrimental to health and vigor. He went on to argue that that was a sufficient

reason for declaring in favor of an artificial system of ventilation; because, he said, if your factory or schoolroom is overheated, evidently the thing to do is to force in air, but it must not be below 60° F. when it enters. That logic, which I think is commonly enunciated by ventilating engineers, seems to me defective. If the factory or schoolroom is overheated, the common-sense, obvious remedy is to *turn off the steam* and reduce the heating surfaces.

As a matter of fact in this country we have for some years been convinced of the desirability of having rooms occupied by human beings, particularly hotels, trains, factories, and schools, kept at something above the outside temperature in winter and, with a national tendency to overemphasis and exaggeration, we have gone to the length of making about 75° or 80° F. the standard indoor temperature in wintertime. Manufacturers and school authorities are literally killing with kindness. We have installed elaborate heating apparatus, and we use up coal in the most lavish manner, with the result that we are creating greater loss than we are avoiding. Now the remedy for that, it would appear, is not to discard heating apparatus but to install another apparatus to offset the one you have already installed. Surely the manufacturer might more reasonably be told, "You can save your earlier expense; you need not install so many radiators; you are damaging your employees, as we are damaging our school children, by this mistaken kindness." To my mind, the thing to do is to teach the employees to throw the windows open.

Mrs. Irene Osgood Andrews, *New York City:* I want to say a word as to the relative value of protection from bad ventilation and protection from disease. Ventilation is a much bigger problem and covers a larger number of persons, and we should be delighted to know what to do about it. We knew, after some study, what was an effective remedy for phosphorus poisoning; we knew after a while about compressed-air illness, about lead poisoning, and something about blindness from wood-alcohol; but we don't know what to do about ventilation. Illinois passed in 1909 perhaps the most effective law, yet I am told that it is only indifferently enforced. The occupational disease law passed last year has met with greater success. Massachusetts has had medical inspection of factories for six years, but Massachusetts has no standard for ventilation. New

York has had medical inspection for four years, but has no standard for ventilation. Those of you who are familiar with New York conditions know that for three years we have been having conferences on ventilation. Last year a bill was proposed and this year the experts disagreed entirely and the bill was cast out. Anyone who can give us information on how to handle effectively and enforcibly this subject of ventilation awaits a place in the hall of fame. We hoped that might be one outcome of the meeting here.

Dr. Frankel has told us what the workman can do. Austria has been behind other foreign countries. But, as an illustration of its recent progress, although fourteen countries have prohibited the night work of women, the period of rest being between ten at night and five in the morning, Austria has now taken the advanced stand that the rest period is to come between eight at night and five in the morning. Before we can expect much of the workman we must have a strong body of labor law back of what we expect him to do. I see no reason why the conditions which Mr. Pratt showed us this morning in his pictures of lead poisoning should not be removed before we ask the workman to protect himself. I think that must be the line of progress in this country.

Dr. C. T. Graham-Rogers, *Medical Inspector of Factories, New York:* I think the subject of ventilation has been pretty well covered by those who have discussed it, and I do not feel that I can add much. It is true that experts on ventilation, instead of agreeing, have disagreed, and that the whole subject is in rather a chaotic state, probably because there has not been strong enough cooperation on the part of engineers, physiologists, medical men, and factory workers to get results. There are so many factors entering into the question that I doubt if six months or a year will give us much of a clue to its solution. It will take several years of intensive investigation. But we cannot have any standard ventilation for all industries; each industry stands by itself and in each intensive research must be pursued. We shall get results, not now, but in the future.

Professor C.-E. A. Winslow, *New York City:* I hope very much that this Association will take up specifically the problem of ventilation. If the Association could get experts, men qualified to take up these problems, it would mean a great deal of work and time, but the results would be of great value.

I face the logical conclusion: If the only problem is overheating we can do without ventilation. But aside from the heat question we have to change the air in order to remove the odors, the dust, and the fumes. Whether they hurt or not they have to be removed. And we have to have tempered air. In a hospital you can do what you want with patients, but in a factory you cannot have the people making complaints, so the windows have to be shut, and I doubt if it would conduce to the efficiency of the industrial worker to do otherwise.

MRS. FLORENCE KELLEY, *National Consumers' League, New York City:* One point has not been clearly brought out in the discussion of poisonous trades and occupations. We were shown this morning pictures of common laborers shoveling lead, filling the air with dust in its most poisonous forms, for themselves and for everybody else to breathe, and to my lay mind it was a most horrifying spectacle. I do not know much about it, but I had not had a conception that there were men who would do such work, especially when it is not necessary in this or any other country. Would it not be possible to have the officials of a state where the lead industry is carried on publish the pictures and an explanation of apparatus in use by standard concerns, which eliminates the poisonous process, so the workman could be intelligent in his choice of occupations? Could not that knowledge be spread among the people so that where there is in actual use a successful mechanical method for the elimination of poison there need no longer be any excuse for the primitive process?

DR. DAVID L. EDSALL, *Harvard Medical School, Cambridge:* There is one thing I should like to say in relation to a subject of which Dr. Cabot spoke. It is important that hospitals keep records and that physicians be trained. The hospital records, if available, would be the best thing we could have. At present it is impossible to get any satisfactory facts which are precise enough to amount to anything. Except a careless name like "laborer" to describe a dozen different occupations, we find nothing to indicate what a man is doing. Hospital physicians need to be urged to contribute their share to the solution of the problem of industrial diseases.

Hospitals should also have exhibits which they could use to teach

the patients themselves what they should do. Undoubtedly one of the best effects of the German insurance laws has been their effect on health, and one of the most important ways in which they have affected health has been through the graphic education they have given. The education that has spread among the people as to right methods of living has been one of the most advantageous things the country has had.

The hospital must be looked upon as one of the centers for spreading information in regard to hygiene. I do not see any reason why our hospitals should not spread a great deal more information than they do on health matters.

Dr. Warren Coleman, *Chairman:* In Bellevue and no doubt in the larger hospitals of the country, the physicians themselves take little or no part in acquiring sociological data concerning the patient. At Bellevue we have our bedside card, one side giving the sociological data and the other the bedside data. The sociological data is filled out in the lower office by an untrained person. That could be corrected, but they are not disposed to pay salaries to trained persons for that character of work.

Again, there is no nomenclature to which we can turn to determine what a man's occupation is. A committee has been appointed for the purpose of getting up such a nomenclature. It will be a heavy task, but in the course of perhaps a year of two years we shall probably have some such thing. Not long ago a young man came into my ward as a patient. He was sixteen and gave his occupation as lithographer. I thought I would cross-question him and find out just what he did. I found he swept the floor in the lithographing room and in winter swept the snow off the sidewalk; yet he had gone down on our records as a lithographer. There are many other similar points to which I could refer.

Dr. John B. Andrews, *Secretary, American Association for Labor Legislation, New York City:* The medical profession can furnish us with information which we can spread broadcast in the form of leaflets among the workers and employers. Professor Thompson of New York has prepared a leaflet on lead poisoning which he has been using in his hospital work and from which he is getting interesting results. Why cannot that plan be worked out in every hospital?

There was a second point that I hoped Dr. Cabot would emphasize,—the establishment of special clinics for the prevention and cure of occupational diseases. We have such a splendid illustration in Milan, where they have three buildings with hospital wards, laboratories, clinics, etc., especially devoted to this subject. I hope that within the next ten years we shall have in this country half a dozen of these institutions. It may be necessary to begin the work with general hospitals and I think Dr. Cabot and Dr. Edsall will be among the first men to superintend such plans. We must have medical men with the tools at hand working all the time supplying information for the prevention of these industrial diseases.

IV

STATE PROMOTION OF INDUSTRIAL HYGIENE

Presiding Officer: HENRY W. FARNAM
Yale University
NEW HAVEN, CONNECTICUT

EDUCATION FOR THE PREVENTION OF INDUSTRIAL DISEASES

M. G. Overlock
State Inspector of Health, Massachusetts.

Standing to-day at the very portals of a vast field of opportunity, I can see stretched before me a decade of achievement in human efficiency unparalleled in the history of the world. Your organization has tilled the bare edges of this field, and the fruits of its labor has attracted the attention of every student of human events. The mighty stride of our industrial and commercial America is the wonder of all the nations of the earth. And the superior skill of our American workmen is attested by the fact that, although the machines of the American Shoe and Machinery Company are scattered throughout Europe, shoes made upon the same machines by American workmen are still eagerly sought, because of their superior finish and workmanship, by Europeans.

The maintenance of human efficiency at its highest standard must be the watchword in the next decade. And, if kept at high-water mark, it will rebound to the credit, satisfaction, and glory of those who have to do with and who bring about the application of tried and found-true principles of personal hygiene for the avoidance of industrial accident and industrial disease. The prevention of such diseases must be brought about by a systematic course of education, with the cooperation of the numerous agencies at our command. These agencies, taken in the order in which in my judgment they belong, should be: first, medical colleges; second, industrial clinics; third, industrial hygiene exhibits, both traveling exhibits and museums; and fourth, publicity by means of lectures, leaflets, and posted warnings. Laws drawn up for the protection of working people from disease are themselves, moreover, educational, and employers can do much to assist the movement.

I. Medical Colleges

At the present time an opportunity presents itself to the medical colleges of this country which is most opportune. If these institutions of learning will add to their curriculum a department for the diagnosis and treatment of industrial diseases, they may be, by their cooperation with boards of health and bureaus of factory inspection in the various states in which they are located, a potent factor in impressing upon the different legislative bodies the need for proper health legislation and for proper appropriations to carry out this work. Medical men thus trained, reporting all industrial diseases to the central body and keeping in close touch with the boards of health and bureaus of factory inspection in different states, may by this cooperation be of immense value to that great army of workers whose occupations make them susceptible to industrial diseases.

What is the legislation necessary to bring this about? To my mind the system under which we are working in the state of Massachusetts should be in vogue in every state in the union. Every state should have medical men as state inspectors of health, working under the direction of a state board of health or bureau of factory inspection, and reporting their findings to the central health authority. It is my candid opinion, and I feel that it is also the opinion of the physicians generally throughout Massachusetts, that the act creating the state inspectors of health and setting forth their duties was a most important legislative action. For it is well to remember that they are the only large body of physicians on this continent who, acting in the capacity of state health officials, study the health, including the moral, social, and physical habits of the people, within and without the factory. Their investigations include, among other things, an inquiry into cleanliness, ventilation, the condition of the air, eyestrain, temperature, artificial moisture, the proper removal of dust, a proper system of lighting to avoid injury to the eye, pure drinking water, receptacles for expectoration, excessive humidity in textile industries, exposure to extreme heat in laundries and foundries, and exposure to lead and other industrial poisons,—in fact, a scientific study with a view to the elimination of all causes which lead to industrial disease. Those of us in the field feel that we are working under the direction and careful scrutiny of those who have made the prevention of disease their life study and who are ever willing and anxious, so far as the means at their

command will allow, to make scientific application of every health principle.

I believe that the emulation by every state in the union of the methods now in vogue in the state of Massachusetts will, within a decade, produce results of which this nation may be justly proud. Then, as I said in the beginning, the medical colleges, by their co-operation with the state boards of health and bureaus of factory inspection, could with profit to themselves and to the community and the state, turn out men whose training would aid greatly in the reduction of industrial diseases. Because it is plain that these colleges, using the deductions made from the experience of the state health officers in the field, would be working on facts and not on theories.

II. Industrial Clinics

The results and experience at Milan, Italy, and the opinion of medical men who have followed this clinic and its workings show, I believe, that we should have an industrial clinic in each of the large industrial centers of the United States. This seems to me an excellent opportunity for our philanthropists, but it could also, in my judgment, be taken up with benefit and propriety by the United States government. The money thus spent would make for efficiency in our industrial life, would be conducive to a greater degree of health among the industrial classes, and would be of inestimable value to the millions yet unborn. I therefore suggest that the Association for Labor Legislation, by the appointment of a proper committee, take this matter under advisement.

III. Industrial Hygiene Exhibits

As I said in the beginning, this campaign for the betterment of the condition of the man or woman who works, to be efficient and far-reaching, must necessarily be a campaign of education. I feel sure that you will agree with me that the traveling exhibits, particularly those which have been sent out by the Boston Association for the Prevention of Tuberculosis, as well as those from other cities and states, have been of immense educational value and have left a strong impression upon the lay mind, as well as upon the minds of members of the medical profession and of social workers,—in fact of all who visited these different exhibits. It would seem to me that we might establish an industrial hygiene exhibit which could be

sent from city to city and which would have a stimulating influence upon those at the head of industrial establishments, who have an opportunity to provide sanitary conditions in modern up-to-date factories. It would also bring to the laboring man the realization that, after all, the scientific application of the principles of sanitation and hygiene are being worked out for the betterment of the working class.

Such an exhibit would have another effect. It would ask a question of the landlord who is renting insanitary and ill-kept dwellings to the working classes. This question in substance is: If the manufacturer furnishes excellent sanitary surroundings for working men and women ten hours a day, why should I not furnish tenements with equally healthful conditions and surroundings for these people during the remainder of the twenty-four hours? In fact, in Massachusetts, with its rigid enforcement of factory laws calling for proper light, cleanliness, removal of dust, pure drinking water, receptacles for expectoration, and numerous other health measures, the question is often asked: "Why have we not a tenement-house law that will place the conditions of the home on a par with those of the factory and shop?"

Such industrial hygiene exhibits might be brought together at some central place, thereby forming a museum which could be visited by those anxious to learn just what is being done for the man and for the woman who works.

IV. Publicity Through Lectures, Leaflets, and Posted Warnings

In 1908, in the eleventh health district in my state, I began a series of noon-day talks in the different large manufacturing establishments, particularly those located in the city of Worcester. If I may speak without egotism, I believe that these talks were of immense educational value. They were given in lay language on questions of personal hygiene and sanitation, including the use of pure air and the importance of proper exercise, diet, and rest. These lectures were largely attended. I have in mind at this moment one establishment employing at that time twelve hundred women where, when a notice was posted a few days in advance that this talk was to be given, nine hundred remained at the factory during the noon hour to listen to what they must have considered a question pertinent to

their welfare and well-being. In a number of instances manufacturers shut down at half past eleven o'clock to allow their employees to attend my lecture without its interfering with their noon hour. During these lectures I usually distributed a little circular on "Don't", setting forth briefly, and recommending the avoidance of certain habits detrimental to health. These little leaflets were eagerly sought for; I believe they were carried home; and perhaps the suggestions were followed. At any rate, I had the satisfaction of knowing that I had set the people to thinking. Since that time I have been pleased to learn that these lectures have been delivered in several other states.

It is my opinion that the posting of warnings, whenever this can be brought about in large industrial establishments, will be prolific of much good, as they readily attract the attention of all the employees and at least set them to thinking as to their meaning. I also feel that an excellent means of educating the industrial worker is by the distribution of leaflets through the different trade-union organizations. A great deal of good can be brought about in this way, and especially effective work may be done by calling the attention of the employee to the ordinary care needed in the handling of articles or chemicals which might in numerous instances be conducive to the production of poisoning. For example, attention may be called to the need of ordinary care in preventing lead poisoning. These leaflets, gotten up in a plain, readable manner, and printed in the several languages used by the employees in the different industries, might be made of great educational value.

V. Ventilation and Eyestrain Laws

In Massachusetts the law covering the ventilation of factories and the installation of mechanical ventilating apparatus (Chapter 106, Secs. 51 and 52) has, I believe, brought into play factors which tend in many instances to the maintenance of bodily resistance, as well as to the prevention of many industrial diseases. This law provides that "a factory in which five or more persons and a workshop in which five or more women or young persons are employed shall, while work is carried on therein, be so ventilated that the air shall not become so impure as to be injurious to the health of the persons employed therein and so that all gases, vapors, dust or other impurities, injurious to health, which are generated in the course of the manufacturing process or handicraft carried on therein shall, so

far as practicable, be rendered harmless." Should elements detrimental to the health of the employees be found in any of these factories or workshops, the state inspector of health may require the installation of mechanical ventilating apparatus. In any instance where much dust is generated, if it appears to the state inspector of health that the inhalation of such dust would be substantially diminished without unreasonable expense by the use of a fan or other mechanical means, such fan, if he so directs, must be provided, maintained, and used. In all of the dusty trades, as well as in rooms which are close and poorly ventilated, the installation of fans and blowers has had its effect upon the health of the employees. The enforcement of this statute does away with vitiated and foul air, to which otherwise the employees must be subject.

Numerous examples of the practical working of the law might be given if space permitted, but in passing I will mention two. In the basement of a large manufacturing establishment, where about forty men were employed, the air, which appeared damp, was heavy and charged with carbon dioxid, and the men were continually suffering from colds. The installation of two small fans and the covering of several emery wheels, which were provided with suction pipes, clarified the atmosphere to such an extent that the men told me they felt as if they were working in the open air as compared with the conditions under which they had worked before this apparatus was installed. They said that they had fewer colds, that they felt more like working, and that they could do better work without getting tired. In other words their physical condition underwent a change almost immediately after the installment of the apparatus mentioned and the removal of the foul and heavy air.

In another instance, in the weave room of a large cotton mill where about forty girls were employed, the air was close and heavy, the girls went about their work in a listless manner, and hardly a day elapsed during certain seasons of the year but several of them were out on account of not feeling well. After the installation of a large fan, which removed the dust as well as the overheated atmosphere and allowed fresh air to take its place, a change was immediately brought about which was at once noticeable to the eye of the inspector. There was less absence from work, denoting, of course, less sickness among the employees, and the manner in which they applied themselves to their work showed that a higher degree of

efficiency was being maintained, and that their general health was much better.

Massachusetts, I believe, is the only state in the union which has passed any act relative to injuries to the eyes of those employed in industrial establishments. This, I believe, is an excellent law and will do away with many cases of eyestrain, of headache, and of nervousness, which arise from improper lighting of the rooms in which people are employed. In going into this question, we look first to the natural light and attempt to bring about, by a careful study of the different establishments, the best condition obtainable from natural light. The question of artificial lighting, the kind of light and its effect upon the eyes, is next gone over, and the best light which our experience and judgment dictates is ordered installed. In many instances simple washing of windows and orders as to their care have wrought a wonderful change. In others, the placing of more windows in such a position as to give the best possible light has proved beneficial. Then again, the whitewashing or painting white of the walls and ceilings of many rooms has made a change in the condition of the eyes of the employees. On entering one of these establishments, we first determine the kind of work, whether it needs close application of the eyes or not, whether many of the employees are wearing glasses and, if so, why they are worn, and then we determine the effect of the artificial light or the rays of light admitted to the room upon the eyes of the employees. Questions are asked as to the length of time employed in the present occupation, the condition of the eyes previous to this employment, and the difficulties, if any, under which the employees are working.

As this law is new, and as many changes in the lighting of establishments are being made throughout the state, we are as yet unable to judge of the beneficial results which we hope to obtain. From my personal observation, however, I believe this to be an important step which the state has taken, and I believe that eyestrain and kindred industrial diseases, which heretofore were caused by inadequate and improperly lighted rooms, will be done away with to a large extent. There is no doubt in my mind that many internal disturbances, particularly what is known as dyspepsia or nervous indigestion, which is in many instances the result of eyestrain and which has become distinctly an industrial disease, will be done away with. If this be true, it is plain that the general condition of the

worker must be bettered. Physicians, of course, have for a long while realized that much malnutrition and consequent general weakness has been brought about by eyestrain. And no one whose occupation requires close application to fine work can escape its deleterious effects and its consequent influence over the general nervous system. This, of course, leads up to the whole question of industrial disease as related to the eye. In comparing notes with the several inspectors of health throughout the state, we can arrive at but one conclusion and that is, that the judicious application of this statute will be rich in beneficial results to the industrial worker.

VI. Employers' Tuberculosis Agreement

It is said that all medical men have hobbies. I believe once in a while, however, the laity credit us with entertaining practical ideas. Appointed state inspector of health in 1907, with instructions to inspect and examine minors in various industries throughout my district, I knew I should find tuberculosis. I reasoned that in the vast majority of cases, when I found this disease in a boy or girl, I should also find that they did not have the four dollars a week required of all who would enter a sanitarium, even if such opportunity was open to them. I have since found it to be a fact that more than ninety per cent of the workers, when stricken with this disease, have not saved for the so-called rainy day. After one of my noon-day talks a young girl approached me saying that she had listened to the hope which I held out to those having tuberculosis that they might be cured if sent early to a sanitarium. She told me that she had tuberculosis but that she had an invalid mother whom she must support, and that she had no money. I took up this case with the president of the company for whom she worked, and he not only assured me that he would pay for this girl, but that he would pay for any other of his employees who might be so stricken. I asked him if he would give me a letter to this effect. He did, and I then saw a vast field opened before me. I went to other manufacturers, asking for the same pledge, and in a short time I obtained more than a hundred similar pledges.

This was the starting of what the *Survey,* in April, 1910, saw fit to call the "Overlock Tuberculosis Agreement". This movement quickly spread throughout the city of Worcester and the surrounding towns. It attracted the attention of the Boston Chamber of Commerce, which body, by accepting a year later a recommendation of

their committee on the prevention of disease, adopted it without a dissenting voice. Boards of trade and merchants' associations throughout New England took up the matter as bodies. The movement has spread from city to city and from state to state, until I find, by conferring with my coworkers in different states, that this agreement at the present time protects more than a million people.

In a year's time, moreover, the work which I had done began to bear fruit in a different direction, which I had not anticipated in the beginning. Young men and women were sent to sanitariums, into the country, and to their homes across the sea, and were then sent back as arrested cases to become teachers in sanitation and health matters. At the present moment I think I can say that there are in different parts of New England and the eastern states more than five hundred cases under treatment, the expenses of which are paid by their employers. My hope now is that this movement may spread throughout the United States.

This movement, outside of its humanitarian and economic features, has set the manufacturers to thinking. They began at once to reason, first, as to why they should have tuberculosis among their employees; second, as to whether, if it did occur, it was because of the surroundings under which they were working; and third, what were the steps necessary to place their different establishments under a sanitary regime and to remove as fast as possible all causes which lead up to the lowering of vitality and resistance in their employees. They soon learned, also, that by placing their establishments in the best possible hygienic condition the efficiency of their employees was increased. I have been much gratified in the past three years by the whole-souled cooperation of the manufacturers in this movement. They at once began to extend the welfare work, in their several establishments, so that at the present time not only do many of the large establishments provide recreation halls, but they are serving the noon-day meal at its bare cost. This sentiment existing among the business men of a community must necessarily have its effect upon the whole community. The local health authorities, who in too many instances in the past have been sadly remiss and dilatory in the manner in which they enforced laws, have had it pointed out to them that they must cooperate in matters pertinent to the health of the community.

The steps taken for the eradication of tuberculosis from industry

are the very steps which must be taken for the prevention of industrial diseases in general. This movement, in the localities in which it has been applied, unites, we find, all sects, all creeds, all schools of medicine, in one common brotherhood. Your organization, acting in conjunction with the organized forces which I have mentioned, may be a most potent factor in bringing about the cooperation of the various agencies needed in the campaign of education for the prevention of industrial diseases.

NOTIFICATION OF OCCUPATIONAL DISEASES

CRESSY L. WILBUR
United States Bureau of the Census.

The notification of occupational diseases has a somewhat similar relation to the registration of deaths from occupational diseases that the notification of births has to the registration of births. Notification in each case—and to be entitled to be considered real notification it must be immediate—is for the purpose of giving the earliest possible information to the authorities charged with the supervision or control of the class of events. Immediate notification of births is chiefly for the purpose of enabling the sanitary authorities to insist upon the necessary precautions for the prevention of ophthalmia neonatorum and of infant sickness and mortality. It is not intended to replace the registration of births, for which a reasonable interval must be allowed, at least in rural districts; but it may serve as an important aid in securing complete registration, while the birth registration law may in return help to secure the thorough enforcement of notification. The purposes of such laws may be combined, as in the recent Massachusetts statute, which provides that physicians and midwives shall, within forty-eight hours after the birth of a child, mail a notice thereof to the local registrar (notification), and within fifteen days file a certificate of birth (registration), but that the notification shall not be required if the birth is registered within forty-eight hours.

In like manner the notification of sickness from occupational disease will be followed, in a certain proportion of cases, by the registration of death. The notification of all cases of occupational or industrial diseases ought to be a most valuable aid for the complete and satisfactory registration of all deaths from such diseases; and likewise the registration of the deaths should be a most important check on the completeness and promptness of the notification. It is, therefore, desirable that the notification and registration of occupational sickness and mortality should be thoroughly

correlated, and for this reason it will probably be found necessary to administer them under the same general direction.

The notification of occupational diseases may properly be considered a part of the general subject of the notification or registration of sickness in general. The reporting of sickness is a very difficult matter to deal with, and morbidity statistics are, as a rule, far less complete than statistics of mortality. Even with respect to some of the most important infectious diseases, such as typhoid fever, diphtheria, and tuberculosis, it will be found that in some localities many cases fail to be reported. This is readily shown by comparison of the reported cases of sickness with the deaths registered, according to which a most absurd ratio of fatality will not infrequently be shown. Such indications prove that physicians fail to a considerable extent to report the occurrence of notifiable diseases; and knowledge of this fact by the sanitary authorities should lead to rigorous enforcement of the law, with prosecution and the collection of fines when it is disregarded. It is likely that the same condition will be found to exist in the administration of laws requiring the notification of occupational diseases; and the whole experience of general registration points to the necessity of rigid and thorough enforcement of law from the very beginning, if fully dependable results are to be obtained and the true value of such legislation is to be demonstrated. It is far easier to enforce a reasonable law from the start than to restore the efficiency of a law that has become more or less of a dead letter.

The registration of sickness does not come in the scope of the Bureau of the Census, which receives and compiles the returns of deaths from the registration area of the United States. I shall, therefore, deal chiefly with the relation of the notification of occupational diseases to the registration of deaths from occupational diseases. It may be proper to point out, however, that the reported mortality from occupational diseases is as yet relatively insignificant, and the true measure of the loss of health and effective working power can only be learned from well-kept morbidity returns. For example, during the year 1910 there were, in the registration area of the United States, comprising an estimated population of 53,843,896, or 58.3 per cent of the total population of continental United States, and including practically all of the chief industrial states of the north and west, only one

hundred and thirty-six deaths reported from chronic lead poisoning and six deaths from other chronic occupational poisonings out of a total of 805,412 deaths from all causes. All the deaths from chronic lead poisoning were not occupational in character. The very small number of deaths (six) from other chronic occupational poisonings includes all deaths reported from phosphorus necrosis (whether specified as industrial or not), from chronic industrial arsenical and mercurial poisonings, etc. It is likely, however, that some deaths that should have been classified under this title were omitted because the certificates of death bore no evidence as to the industrial character of the poisonings, and some may have been reported under terms relating to mere symptoms or conditions, such as "paralysis," "necrosis," etc., that afforded no clue to the true nature of the cause of death. The returns were compiled in strict accordance with the international classification; and it is impracticable for the Bureau of the Census to investigate all doubtful statements of cause of death, although this is done to a certain limited extent. The responsibility for indefinite reports rests, primarily, upon the recording physician, and, secondarily, upon the local registrar of vital statistics who accepts a doubtful certificate and issues a burial permit thereon.

It may be noted in the above statement in regard to "occupational diseases" that the term is used in the very limited sense of occupational poisonings, and not in the broader sense of all diseases affected by occupations. Thus the draft of the "Certificate of Industrial Diseases" issued by the New York State Department of Labor provides for the reporting of "poison by lead, phosphorus, arsenic, or mercury or their compounds, or from anthrax, or from compressed-air illness." The schedules of California, Wisconsin, Connecticut, New Jersey, Maryland, and Michigan are the same as that of New York, while Illinois requires the reporting of "disease or illness due or incident to" a few specified dangerous occupations. The very recent introduction of such legislation is indicated by the fact that these eight states are the only ones having such laws. The report of the Illinois Commission on Occupational Diseases (January, 1911) related chiefly to industrial poisonings, although the scope of a more comprehensive investigation was fully pointed out. It may be asked, for example, whether the reporting of tuberculosis caused by, or aggravated by, occupation is contem-

plated as a regular procedure by means of any of the special notification blanks?

It is difficult to define those diseases that may or may not be affected, to some extent, by conditions incident to employment. The general study of occupational mortality is dependent upon comparison of the deaths from various causes of persons engaged in specified occupations with the corresponding populations or lives at risk, and it is hardly necessary to say that regard must be had to the age and sex distribution, as well as to the factors of race and color, in order to obtain comparable results. It is absolutely necessary that there should be a uniform classification of causes of death, that physicians should report the causes of death by means of precise and definite terms that can be readily compiled thereunder, and also that there should be an identical classification of occupations in use for both the population and mortality returns. In order to make the latter of the greatest service, physicians and others must be instructed in regard to the correct statement of occupations.

It is, therefore, very gratifying that a standard form of certificate of death has come into general use in the United States during the last ten years, prior to which time there was very little uniformity in this respect. This blank was originally prepared in 1902 and was revised in 1909 by the organized registration officials of the country (Section on Vital Statistics of the American Public Health Association). I desire to call attention especially to the form of statement of occupation on the present blank, with specification of the "(a) Trade, profession, or particular kind of work", and "(b) General nature of industry, business or establishment in which employed", and to the instructions on the back of the certificate relative to the statement of occupation and cause of death. Although not as detailed as the information sought on the New York certificate of industrial diseases, it was the general consensus of opinion among registration officials that the statement was as complete as it would be practicable to require in the general mortality returns. The necessity for full information in regard to the length of time employed, the previous employment, previous illnesses due to occupation, etc., can best be met by including such inquiries on the notification blank, thus avoiding incumbering the death certificate with many questions in addition to those already required for the general purposes of vital statistics. Thus the two blanks to a

large extent supplement each other, and may be used together as a basis for many important statistical purposes and intensive investigations. It would seriously interfere with the conduct of death registration, the extension of which to cover the entire United States is one of the most important tasks in which the Bureau of the Census is cooperating with state authorities and national associations, to add a single additional question to the schedules, which are already regarded as cumbrous by legislatures and those not familiar with the requirements of registration laws. But a state of high industrial development can readily obtain, by means of such blanks as are provided for notification of industrial diseases, all supplemental data required to make its occupational statistics of the greatest practical value.

A very beneficial means of building up complete and correct statistics of occupational mortality for the United States lies in the education of physicians, undertakers, and others in regard to the proper statement of occupation upon certificates of death, and in training physicians to report the causes of death under precise designations. For the latter purpose a booklet entitled the *Physicians' Pocket Reference to the International List of Causes of Death* has been distributed by the Bureau of the Census to all the physicians of the United States. It contains lists of indefinite and unsatisfactory terms, and also points out the importance of examining the statement of occupation (not usually filled in by the physician) so that full data may be available concerning the occupational influences affecting causes of death. Similar instructions are used by state and local authorities; and it is only necessary, with the growing knowledge of the importance of the statement of occupational diseases, to make such instructions just as precise as may be necessary. I believe that it might be useful for a committee of this Association to consider the subject and to cooperate with the registration officials and with the Bureau of the Census in obtaining more complete returns. Objections not infrequently arise when a local or state registrar questions the completeness of a return of death, that would be removed if a great national organization had pronounced clearly in regard to the necessity for full details.

In this connection I may say that the reporting of the causes of occupational mortality has suffered, in common with all reports of causes of death, from the entire absence in this country of an ac-

cepted nomenclature of diseases. I do not mean by this that we do not have a standard classification, or preferably statistical list, of causes of death and illness. The latter necessity was met by the general adoption of the International List in 1900, since revised at Paris in 1909. But this list is solely for statistical purposes and does not answer the purpose of a nomenclature, or authoritative guide for the selection of medical terms for the designation of diseases and conditions, such, for example, as the "Nomenclature of Diseases of the Royal College of Physicians of London", which has been the accepted authority in England for the past forty years. I am glad to say that the American Medical Association has undertaken to supply this deficiency, and that its Committee on the Nomenclature and Classification of Diseases has held several sessions during the present meeting of that association and will submit a report calling for the publication of a nomenclature for immediate practical use. In this nomenclature, which must necessarily be regarded as somewhat provisional or tentative in character—although the committee has labored upon the subject for several years—precise directions will be given for the reporting of industrial poisonings, and the importance of such reports will be emphasized as earnestly as possible. It is hoped that any suggestions on the subject from members of this Association, and also any action which may be taken by the Association on the basis of the papers presented by Dr. Thompson and others, may be promptly sent in to the committee, a statement and report by which may be found in recent issues of the *Journal of the American Medical Association.*

The nomenclature will be arranged in the order of the International List, in accordance with the original resolution of the House of Delegates adopted in 1907. This is for the purpose of comparability with the statistical lists employed for the compilation of morbidity and mortality statistics. For the essential use of the nomenclature the question of classification is of minor importance. One arrangement may be as good as another for the presentation of industrial diseases, but as a matter of convenience it is desirable that tables should present causes of death as far as possible in the international order. Of course, the titles of the International List can be subdivided to any extent found necessary, but when this is done the aggregates should be comparable with the causes shown under

the corresponding titles in general morbidity and mortality statistics. The Bureau of the Census and the Registrar-General of England have recently published manuals for the assignment of terms to the International List, so that a convenient guide will be available for all offices compiling statistics of occupational causes of death. Thus the general comparability of all classes of mortality and morbidity statistics will be assured.

MEDICAL INSPECTION OF FACTORIES IN ILLINOIS

HAROLD K. GIBSON
Medical Inspector of Factories in Illinois.

Is the Occupational Disease Act of Illinois in its application practical? To this question, although appreciating the fact that our experience is all too brief, I must answer most emphatically in the affirmative. There have been reported, in the period from August 1, 1911, to April 1, 1912, two hundred and forty-seven cases of occupational or industrial disease, which were divided as follows:

Lead	240
Arsenic	6
Phosphorus necrosis	1
Total	247

When it is taken into consideration that in this period not to exceed thirty-one manufacturing establishments were reporting, the importance of this legislation, particularly as it concerns the reporting of occupational disease, may be grasped.

Personal experience has taught me that the Occupational Disease Act, as applied in our state, must fall far short of its mission unless we keep continually before us the idea of education, not only of employee, but of employer. I have with me now, indeed, the mental picture of two large manufacturers of paints whom we will designate as X and Z. Both plants are new and well equipped with modern devices for collecting dust; both have shower-baths, abundant facilities for washing, dining rooms, compartment lockers, working clothes, and regular medical examinations by well-qualified physicians. X reported eight cases of industrial lead poisoning for the month of October. Z reported seven. From this period until April 1, the monthly reports of X have failed to show a single case of lead poisoning; while Z, on the contrary, has reported on an average of four cases monthly since October. Why this great discrepancy in two large industrial concerns using a practically identi-

cal process, having the same number of employees, both of modern building construction and sanitation, and both complying with our occupational disease law? Because X is complying with the spirit as well as the letter of the law, while Z is complying only with the letter. Being present in X's plant recently when the noon whistle blew for lunch, I was surprised to find that X not only allowed sufficient time for thorough scrubbing of the hands and face, but that the firm provided a man whose duty it was to see that all hands were clean before the food was taken from the locker.

It is merely a difference in superintendents, foremen, and shop discipline. An employee in the plant of X knows that the creation of an unnecessary amount of dust, as, for example, in opening a container of white lead, or the failure to wear his respirator where there is dry grinding, means a reprimand from the foreman or, if he is a chronic offender, dismissal. On the other hand, the superintendent at Z plant is a lead man of thirty years' experience, who boasts he has never been leaded, and who believes that chewing tobacco is the greatest of all prophylactic measures in the prevention of lead poisoning. It was interesting to note, however, that this man, although not a user of alcohol, had a blood pressure of one hundred and sixty and peripheral blood-vessels of the consistency of whipcords. Z will not get results in his plant, with all of his modern sanitary apparatus, fans, and dust collectors, until he gets foremen who will personally supervise the hygiene of his men. I grant you that this is not a simple matter.

Quite recently, in the inspection of the linotyping room of one of our largest dailies, equipped with a splendid exhaust system, the men complained bitterly that the exhaust and fans caused colds and sore throats. These are purely matters of education. Then there is the employer who tells you that the men prefer the saloon to the dining room and will not use a shower-bath, and that the men will not wear respirators; he is as badly in need of education as his employees. Demonstrate to him what an intelligent foreman can accomplish.

Will you allow me to tell you of our experience with the Pullman Car Company which, by the way, was the first corporation to comply with the occupational disease law in Illinois? Their first report made after our preliminary inspection showed seventy-three cases of lead poisoning. Bear in mind that they employ between three

hundred and six hundred painters and interior finishers, and that these people are engaged in an occupation, peculiar to the finishing of Pullman cars, which is, I believe from personal experience, the most fraught with danger of any of the occupations in which lead is handled. I refer to the dry sander of lead inside the Pullman car. Here a group of men is confined in a relatively small place devoid of artificial ventilation, rubbing down dry lead paint with emery paper. They told us in the beginning that men could not be made to wear respirators in such a case; that they would want to temporize with a strip of gauze or a handkerchief tied over nose and mouth. I wish to emphasize the point that in this, the most dangerous of the lead trades, the gauze or handkerchief will not do. Only an approved respirator, constantly worn when at work, and the most scrupulous personal hygiene, will save the dry sander of lead. His work admits of no compromise.

To recapitulate, the Pullman company had seventy-three cases in August; they have not had a case for the past four months. They have a perfect equipment of baths, washing facilities, lockers, clothes, and dining rooms; but more than that they have a safety department with a man at its head who is an enthusiast in his work and who believes that lead poisoning in employees can be practically eliminated by personal supervision. Remember, too, that these men, of all classes of lead workers, are doing the character of work which furnishes the greatest number of cases of lead poisoning. That is to say, they are painters and sanders.

Permit me, also, to say a few words upon the importance of what our German colleagues call the *symptom complex* in making a diagnosis of industrial disease. I will refer to lead, as it is easily the most frequent and has the most disastrous final results of any of our industrial poisons. The blue line is by no means pathognomonic of lead poison, nor is a basophilic degeneration unless a previous malaria can be excluded, and it must be borne in mind that many of our lead workers, at least in Illinois, come from the malarial belt of southern Europe. Muscular weakness in any group of muscles with anemia I regard as most suggestive, even without colic or blue line. You must not ask a man if he has abdominal pain, but if he has pain and where, giving importance to the group of symptoms rather than to any one symptom, unless, of course, it be a wrist-drop or a typical colic. I have found what I considered a well-marked case of

lead poisoning where there was no history of pain, muscular weakness or paralysis, and no blue line, but a moderate anemia, albuminuria, and a blood pressure of one hundred and eighty, with a basophilic degeneration. Of course, in estimating the value of blood pressure, one must exclude alcoholism and evidence of venerial disease. Just a word in regard to the importance of basophilic degeneration as a sign of lead poisoning. In a series of twenty-six cases, all of which presented a certain degree of anemia, I found this sign present in twenty-one cases.

If I have dwelt upon lead to the seeming exclusion of other poisons, it is because of its commercial importance. I am sure that we in Illinois owe a debt of everlasting gratitude to this Association and to your honorable secretary, in particular, for his efforts in the matter of white phosphorus legislation. The Esch-Hughes Act will eliminate one plague spot from our industrial disease map in Illinois, and one which was particularly offensive, as 70 per cent of the employees exposed to the fumes of phosphorus were girls under the age of twenty. But consider, I beg of you, that while phosphorus necrosis is a loathsome disease, yet it is strictly a local disease, and where it numbers its victims in tens, lead numbers its victims in thousands. I wonder how many lead workers of all grades could obtain a standard life insurance policy at the age of thirty-five. Remember, too, that the atheromatous changes produced in the vessel walls by lead, as also the kidney changes, are permanent.

COMPRESSED-AIR ILLNESS IN CAISSON WORK

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Under conditions as they exist in New York at present employment in compressed air is not such a dangerous occupation as it was a few years ago. As improvements have been made in equipment for lessening the laborious part of the work and for overcoming the difficult problems of engineering, so has there been a great advance toward bettering the conditions under which the men are working. Chief among the altered conditions which have lessened the dangers of loss of life from caisson disease are: (1) physical examination of all employees; (2) shortening the hours of labor; (3) hospital locks, in charge of qualified attendants, where victims of the "bends" can be immediately recompressed; (4) lengthening the time of decompression in coming from work; (5) substitution of electricity for candlelight; and (6) a greater tendency on the part of the men to sobriety.

I am speaking now with reference to the work of sinking caissons for foundations of buildings, and particularly of the compressed-air work during the last five years in connection with many of the large buildings in lower Manhattan. Caissons or large vertical boxes are sunk to rock or hardpan, as necessity may demand. As the earth is excavated from underneath and inside the boxes the caisson settles, so that when rock or hardpan is reached we have a hollow vertical cylinder, or a miniature tunnel, leading from the surface of the ground to a solid support. For a building which extends over a large area a great many of these caissons have to be sunk. In the case of the municipal building of New York, for example, one hundred and six caissons were sunk to a depth of one hundred and twelve feet below water level and one hundred and thirty-five feet below the street level. These boxes or caissons are sunk in groups of three, four, five, or six, so that a force of from one hundred to one hundred and fifty men, or even as many as five hundred men, are employed at one time. The air is pumped from air compressors to the caissons and the pressure varies ac-

cording to the depth of sinking, so that at the same moment we may have one caisson, which is nearing its destination, having a pressure of as much as forty-five or forty-six pounds and another one, just being begun, having a pressure of only two or three pounds.

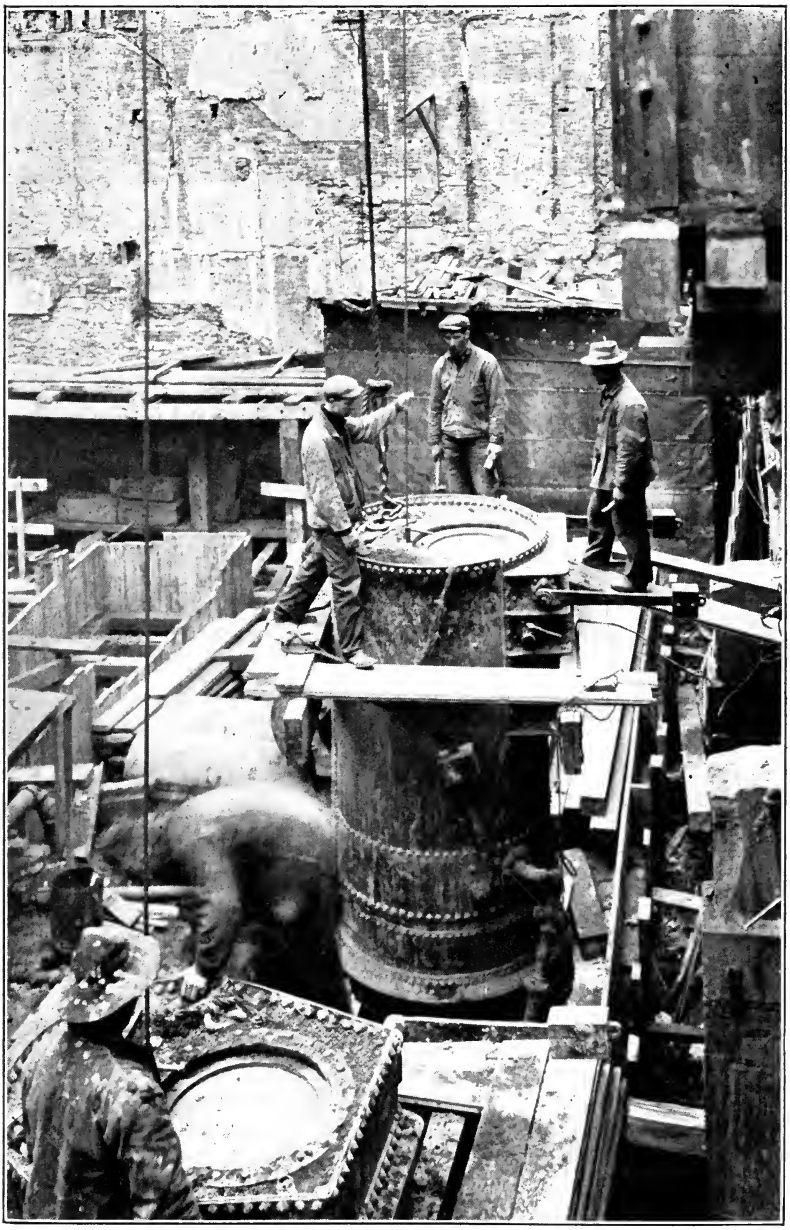
In caisson work we have a few difficulties to be dealt with that are not met in tunnel work, but in the main the problem is the same. The percentage of cases of compressed-air disease in my experience has been lower on foundation work than in tunnel work, in spite of the fact that under most circumstances employees in caissons are working under more disadvantageous conditions than tunnel workers. The reason for this is, I think, that in tunnel work, up to the present time, for the same pressure the men have worked longer hours. In caisson work our main difficulty in the past has been in lengthening the time of decompression on exit from work. One reason for this is that, on account of the comparatively small size of the lock used in this work and through which all employees must pass, it is a much greater mechanical problem to diminish the pressure gradually. I mean that, comparing two locks, one large and the other small, with an equal pressure of air on them, if you release the same amount of air from each through the same sized valve, the pressure in the small lock will drop much more quickly than in the large one. Another reason is that the lock used on the caisson, in contrast with tunnel work, is not permanently placed, as it must be lowered with the caisson. The necessity for the frequent removal of locks leaves a greater margin of chances for leaks to occur from time to time, and from a leaky lock it is almost impossible to release the air slowly. In addition, the cramped position that the air worker must assume while sitting in the bucket during decompression differs from the comparative comfort with which he issues from a tunnel lock. Another feature of caisson work that has to be reckoned with is the environment of a busy city, as compared with the location of a tunnel plant which is usually in a more secluded section. In the former case the force of men, like the pressure of the air, is constantly changing; in the latter the tendency is more for the force to be a steady one, for the men have a pressure to work in that is pretty nearly constant and is not accompanied with the same degree of uncertainty.

In considering the problem of how to care for the men, the

two factors that are of the utmost importance are: (1) the rejection for work of all physically unfit; and (2) slow decompression in coming from work. The only death that has occurred in any of the work of which I have had charge during the last five years was due to a pressure of only twelve pounds of air where a man had gone to work without having been examined. Post-mortem examination showed that he had had a dilated heart which ruptured from the strain of a fairly rapid decompression. Very few cases of caisson disease occur in a pressure less than twenty pounds. In the examination of the men it should be borne in mind that it is an extraordinary occupation in an extraordinary atmosphere, and only extraordinary men should be employed. They should be physically above the average, between the ages of twenty-one and forty, of slender build, non-alcoholic, and with absolutely sound heart and lungs. Any variation from normal, even in rate or regularity of the heart, should be enough to reject a man. No man with symptoms of any organic disease should be passed.

The fight for slower decompression has not been with the contractors so much as with the employees themselves, and I do not believe that the reason is so much the desire on the part of the men to get away from their work quickly as it is a spirit of bravado that prevails with nearly all. There is a certain contempt developed for the air, the result of familiarity. As they say, they can "eat air". Reason and a few painful lessons, however, have diminished this spirit to a great extent and, by the placing of responsible men in the position of lock-tender, we have been able to regulate the time to much better advantage. Nearly all cases are caused by too rapid decompression, and my experience has been that where the decompression has been slow no serious case has ever resulted. It is my belief that if a sufficiently long time were taken for decompression we would never have a fatal case in an otherwise healthy man.

The time that should be taken for proper and scientific decompression depends directly on the amount of air that is dissolved by the blood under pressure. And the amount of air dissolved by the blood is determined by (1) the length of time spent in the air, (2) the number of pounds of pressure, and (3) the amount of exercise undertaken in the air. A lock-tender may go rapidly in and out of very high pressure with no ill effects,



AIR-LOCK ON TOP OF CAISSON

In Sinking Foundations For Skyscraping Buildings Men Go Down Beneath the Water Level and Work In Compressed-Air Chambers Or Caissons

The Air Pressure is Frequently More Than Three Times the Normal Fifteen Pounds Per Square Inch. Workers, If Released Gradually During Decompression in the Air Lock, Avoid the "Bends", or Compressed-Air Illness

as his stay in the air is short. Superintendents and engineers, whose stay is shorter than that of a regular shift and who do no manual labor in the air, do not suffer from the "bends" as frequently as do the diggers.

In addition to the purely mechanical problem as a causative factor, we have to take into account the individual susceptibility to caisson disease. Five men of apparently the same physical condition come out of a caisson under absolutely the same conditions. One of the five is attacked by the affliction and the other four are unaffected. What determines this susceptibility? The blood of each undoubtedly dissolves the same amount of air under pressure, and when the pressure is reduced the air comes out of solution in precisely the same length of time. Authorities differ as to the change in pressure in the vessels, but to my mind this is a real and important factor. If the pressure within the vessels were not increased, the blood could not dissolve the air or hold it in solution. Consequently, in rapid decompression we have not only to deal with air in the form of small emboli in the blood stream, but we have exerted against the vessel walls an abnormal pressure which has not had time to diminish at the same rate as the air in the air-lock. The vessel walls of the man in good condition, or rather the man who is the good risk, are able to counteract this pressure and carry the air to the lungs where it is expelled. The man whose vessel walls dilate under this pressure is not able to get rid of his air so quickly, and the small emboli collect in sacculations at the weaker points and remain until recompression is carried out so that the air is again taken up in solution in the blood.

For my own convenience I have classified the different types of the disease as follows: (1) spinal type; (2) cerebral type; and (3) pulmonary type. Each of these is again subdivided into (A) mild variety, and (B) severe variety. Of the spinal type the mild variety is characterized by aching pains in the extremities; and the severe variety by paraplegia and general weakness but no pain. Of the cerebral type the mild variety is characterized by vertigo, nausea and some prostration; and the severe variety by coma, usually hemiplegia, and great prostration, with pulse and respiration barely perceptible. The main symptom of the pulmonary type, which is seen less frequently, is dyspnoea. The mild variety of the spinal type never results fatally, but in rare cases it causes a wasting of the

muscles of the thigh by a gradual process which involves the hip-joint as well. The severe variety, with paralysis of the legs, never terminates fatally except from the secondary results of a myelitis, where treatment has been of no avail. The milder variety of the cerebral type is due probably to a disturbance of the internal ear and terminates favorably; but the severe variety of the cerebral type, characterized by coma, is fatal in many cases in spite of any treatment that may be instituted.

In regard to the treatment of the severe cases, everything depends on proper and skilful recompression in the hospital lock. The greatest mistake in the past has been in recompression to the number of pounds in which the patient was working. This is absolutely unnecessary and is highly dangerous. Uniformly good results are obtained by recompressing to two-thirds what the pressure was in the working chamber. This corresponds in some measure to Dr. Haldane's theory of rapid decompression for the first stage. When the desired pressure is attained it is wise to leave it stationary for some time, according to the merits of the case and the improvement of the patient. In all cases of the severe type the medical attendant should be recompressed with the patient and it is his duty to use artificial respiration if necessary, to massage over the heart with movements of the extremities, and in many cases to force the mouth open and promote respiration. When consciousness returns it is wise to encourage the patient to execute voluntary movements and to get up and walk in the lock, allowing him to rest at intervals. Decompression in patients afflicted with the milder variety of the disease can be carried out at the rate of about one pound in four minutes, taking one hour where the recompression has been to 15 lbs. In the severe cases, decompression should be much slower, at the rate of ten to twelve minutes for a single pound,—that is, where the recompression has been to 15 lbs. taking as long as two and one-half or three hours, and where the recompression has been to 20 lbs. taking as long as three and one-half or four hours.

The following is the history of an interesting case followed by recovery:

Name, J——— M———. Age 28. Ht. 5 ft. 6 in. Wt. 160 lbs.

History:—On December 10th, 1909, started to work in 37 lbs. pressure without ever having been examined. He had been quite ill for about two

weeks previously, suffering from a severe cold. Worked for two hours, although he had never been employed in compressed air before. On coming out of the lock was decompressed very rapidly, in about one minute's time, with the rest of the gang. He fell unconscious and was carried to the lock for recompression.

Treatment:—Was at once recompressed with an attendant to 20 lbs., and after the air had been maintained at this level for about ten minutes recovered consciousness and was able to get up and walk about in the lock. He was gradually decompressed, taking a period of two hours. On exit from the lock he felt pretty well, but at the end of fifteen minutes again fell over unconscious and seemed to be quite lifeless. He was again recompressed with myself to 20 lbs. and under the same treatment recovered consciousness in the air. His pulse was weak and rapid, pupils dilated, and body covered with a profuse perspiration. I encouraged him to sit up, after administering strychnine to him hypodermically. Passive movements were carried out with massage and two and one-half hours were taken for decompression. When he made his exit from the lock he felt fairly well, but was noticeably weaker than he was on coming out the first time. He was allowed to rest in the recovery room and restoratives were administered to him. Five hours later he said he felt well enough to get up and walk around, but complained of some dizziness. He was standing up near the hospital lock and was speaking to me when he was seized with a violent convulsion and fell over in my arms. He was again recompressed with me to a pressure of 22 lbs. and the pressure was maintained at that level for an hour before he fully regained consciousness. During that time I was using artificial respiration on him, his jaws held open with a mouth gag and his tongue drawn forward. It was almost a quarter of an hour before he breathed at all satisfactorily. At the end of an hour he could answer questions but only in an indefinite way, and he had a well-marked paresis of his left side. This gradually improved, but he was so very weak that he was inclined to lie down. He wanted to sleep continually. We released him very slowly until at the end of five hours decompression was complete. This was at the rate of one pound in fourteen minutes. He was carried to the recovery room and by that time had recovered entirely from the coma and paresis. He was given some broth and was allowed to sleep for three hours. He rested for two hours more and at the end of that time was so improved that I allowed him to go home.

He never had any recurrence and was able to come around for his pay three days later. Two weeks later he was in apparently good health, but I advised him never to enter even the slightest pressure again. Nevertheless, within three weeks of his illness, he did go to work in light pressure in another part of the city, but only worked a few days. About four months later he had an attack of pneumonia and died.

LEGAL PROTECTION FOR WORKERS IN UNHEALTHFUL TRADES

JOHN B. ANDREWS
Secretary, American Association for Labor Legislation.

The need of labor legislation for the protection of workers in unhealthful trades is so apparent to anyone at all familiar with the facts that argument upon the subject is unnecessary. "Factory legislation", to use the earlier English term, has aimed particularly at the protection of workers from insanitary conditions of employment. Long before any considerable number of people admitted that legal regulation of working hours and of wages was justifiable, there was very general recognition of the fact that the worker was entitled to a decently safe place in which to labor. The reasonableness of sanitary regulations as a legitimate interference with work conditions prescribed by the employer and suffered by the employee, has also been more uniformly upheld by the courts than any other kind of labor legislation.

In general, certain trades are unhealthful and require regulation principally because the workrooms under ordinary conditions are likely to be poorly ventilated. More specifically, the harmful conditions of employment are frequently due to the presence of dusts, gases, vapors, and fumes; to extremes of temperature, humidity, or density of the atmosphere; and to improper lighting and overstrain.

The evil results of unhealthful conditions have long been recognized, and in every industry there are humane and intelligent employers who devote much time and money to the elimination of unnecessary hazards. Whether prompted by humanitarian or commercial considerations, these advanced employers frequently provide model establishments. By their commendable efforts they also help to establish reasonable standards of comfort and safety which, when drafted into labor law, constitute uniform minimum requirements for all employers in the same industry. But only through the uniformity of regulation which legal enactments alone can secure, can these more progressive and humane employers be themselves pro-

tected from less scrupulous competitors who would otherwise often fail to go to the expense of providing adequate safeguards, and only through such compulsory uniformity can the health of the employees of these competitors be protected.

It frequently happens, moreover, that even a vast majority of the manufacturers in a given industry claim that they are unable to bring about reforms, which they freely admit are desirable, without the aid of uniform legal regulations to force the recalcitrant minority into line. A striking example of this, the condition which culminated successfully in the poisonous phosphorus match prohibition act, is still fresh in the public mind. Match manufacturers, representing ninety-five per cent of the total product, testified before Congress that they could not substitute a harmless compound for the slightly cheaper poison without a uniform law compelling all manufacturers in that industry simultaneously to abandon the poison. Match manufacturers representing the remaining five per cent of the product stood out stoutly until the last, declaring that they would close their factories before they would submit to this sanitary regulation already in compulsory operation in practically all the civilized countries of the world. It required labor legislation to prohibit the use of this unnecessary deadly poison before "phossy jaw", the most loathsome of all industrial diseases, could be abolished.

For other industrial poisons there are harmless but more expensive substitutes. Automatic mechanical processes can be substituted for dangerous methods still conducted by hand labor. Scores of operations in the present list of particularly insanitary trades can be made safe by the use of scientific apparatus for the removal of dangerous dusts and fumes.

The unhealthful trades demanding legal regulation may be conveniently classified according to the nature of the principal hazards:

(1) Trades menaced by specific industrial dusts, fumes, gases, vapors and acids (poisonous and non-poisonous);
(2) Trades menaced by compressed or rarified atmospheres;
(3) Trades menaced by improper light;
(4) Trades menaced by extremes of temperature and humidity;
(5) Trades menaced by excessive strain.

Hundreds of peculiar injuries, caused by these unhealthful conditions of employment, are now beginning to receive serious atten-

tion in America as special diseases of occupation. This new line of study is most encouraging to those interested in securing effective legal regulation of unhealthful trades, because it has long been recognized by the people most familiar with the facts that specific studies, leading to the establishment of more definite standards of safety, are necessary before much even of the now existing legislation can be effectively enforced.

While such researches are under way, we should emphasize at every opportunity the following considerations: (1) All preventable occupational diseases must be prevented; (2) those occupational diseases which we do not yet know how to prevent must be reduced to a minimum; and (3) the victims of occupational disease must be compensated for their injuries by some just system of insurance.

Efforts to carry out this program lead naturally to three principal methods:

(1) *Absolute prohibition.*—Through the successful outcome of the efforts to secure a prohibitory tax upon matches made with poisonous phosphorus, an avenue of tremendous possibilities, if carefully followed and not abused, is opened up for the further conservation of human life.

(2) *Regulation.*—There may be specific or general regulations:

A.—*Specific regulation.*—For the sake of clearness we may recall, as an illustration of specific regulation, the earlier history of the match industry, when several countries, before harmless substitutes for poisonous phosphorus were discovered, attempted to prevent "phossy jaw" by requiring, (a) that match paste should contain not more than seven per cent of the deadly poison; (b) that no one should be permitted to work in the poisoned atmosphere of a match factory more than eight hours in any one day, and (c) that children should not be so exposed. There were, then, in this intermediary period of specific regulation, three definite limitations, (1) upon the hazardous material, (2) upon the period of exposure, and (3) upon the persons exposed. By this method of specific regulation also there are extensive possibilities for legal regulation in the interest of human health.

B.—*General regulation.*—This method is, unfortunately, the most common. If, again, for the sake of clearness, we make final use of the match-factory illustration, we recall that be-

fore prohibition was thought of and before specific regulation had been tested, most countries had made vague efforts, through general regulations, to provide education, ventilation, and cleanliness for the promotion of the comfort and health of workers in match factories. This general method lends itself most readily to that large group of trades in which the occupational causes of industrial maladies are least clearly defined. It marks the earliest stage of regulation where, on account of complex conditions of employment, we are still feeling our way in partial darkness without definite standards for our guidance.

(3) *Insurance.*—It is now recognized that the campaign for workmen's compensation or insurance for industrial accidents, both in Europe and in America, has been the greatest practical force in the prevention of such injuries. No intelligent person can go far in the study of insurance against industrial accidents without realizing that a logical consideration of the facts must lead likewise to insurance against industrial diseases. A workman, incapacitated by disease contracted in his trade and due to his employment, is as much entitled to compensation as if he had been disabled by an accident. In many European countries this principle is already established.

In all attempts to control dangerous trades, the method of general regulation has naturally preceded specific regulation and absolute prohibition as well as insurance. On paper it is by far the easiest, and unfortunately it creates a temporary impression of accomplishment which is quite fascinating to the occasional-day reformer. It is probably a necessary first step in most industries where definite, enforceable, scientific standards must wait upon investigation and practical experiment.

In attempting to deal intelligently with these problems, our bill drafters are hopelessly baffled by the lack of scientific standards. And nothing is more clear to serious students of the subject than the unavoidable conclusion that effective laws for the regulation of unhealthful trades cannot be properly drafted by busy and harassed legislators in the midst of legislative sessions. In the field of industrial hygiene, no greater contribution could be made at the present time than the establishment, by a commission of experts, of such standards.

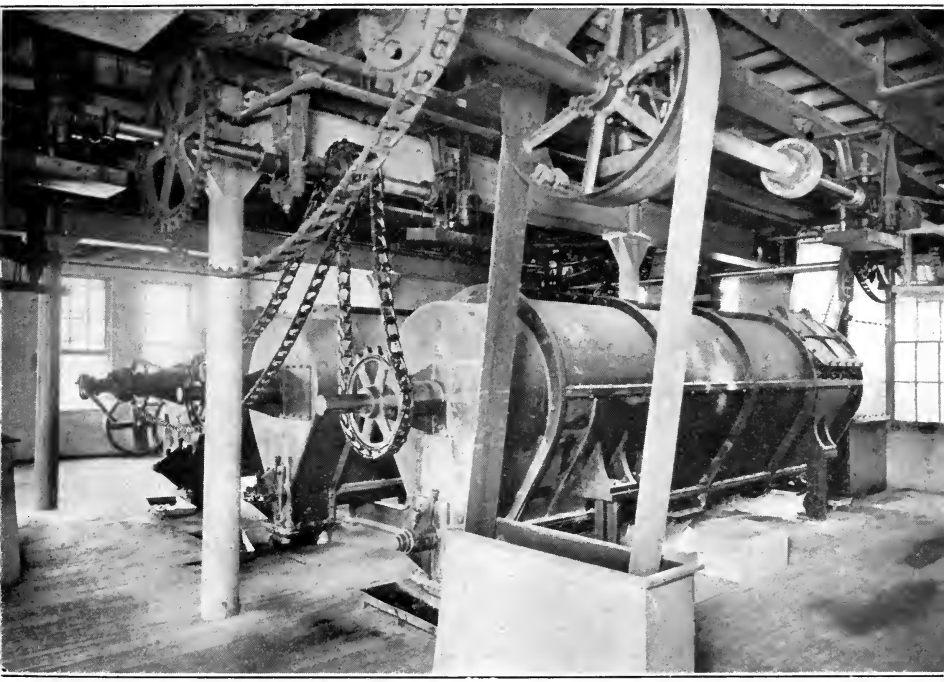
The existing laws in this country for the regulation of factory labor in the interest of the comfort and health of the workers are for the most part formulated on general lines,—confused, indefinite, and full of loopholes. In the fifteen states which even pretend to protect workers from the effects of poisonous gases, fumes, and vapors, the laws seldom give more definite directions than that such dangerous gases, fumes, and vapors must be removed or rendered harmless "when injurious to the health of employees", or "so far as practicable", or "if necessary". In one state the law sweepingly provides for all health protection by stating that the factory inspector "shall also examine into the sanitary conditions of factories, workshops, mines and quarries, and when any condition or thing is found that in his opinion endangers the health or lives of the employees, he shall notify and direct the employer to rectify the same." This class of statute law, which is quite common, places no duty upon the employer to provide proper protection until he is ordered to do so by the inspector. When one considers the area to be covered in our large industrial states, and the number of workplaces to be inspected, it can easily be seen that workers depending for their safety upon the specific orders of a limited number of inspectors are likely to receive entirely insufficient protection from laws of this character.

Although work in compressed air has become an important element in the building trades of this country, New York is still the only state which has a scientific law relating to work of this character.

There are only twelve states that make any mention of the subject of light in their general factory or labor laws. And "in not one of these", says a well-known efficiency engineer, "are the provisions sufficiently specific to render them of practical value."

Laws intended to protect the workers from injurious dusts in factories have been enacted in twenty states, but they are generally very crude and in practice more or less ineffective. "Drastic legal requirements alone", says the leading American authority on this subject, "are certain to bring about the required degree of comfort and health."

One reason that many safe methods are not in operation at the present time is simply that many employers, busy with the making of profits, have had no sufficient incentive to turn their attention to factory sanitation; and another reason is that state factory inspect-



"SEPARATING SCREENS" IN WHITE-LEAD FACTORY

A Once Dusty Process Is Here Made Practically Free From Lead Dust By the Use of Enclosed Churn-Like Machines Which Sift the Metal from the Corroded White Lead

ors have not always been fully aware of their opportunities and responsibilities. The motive which leads some intelligent employers properly to equip their plants with safeguards is undoubtedly the conviction that it increases the efficiency of their workmen. There is abundant testimony to that effect from the rapidly rising profession of efficiency engineers and from their patrons. But even the most enthusiastic "boosters for safety" among the thoughtful efficiency experts recognize the absolute necessity for the establishment of uniform legal standards of safety if the health of the great majority of factory workers is to be conserved.

Recently a few of the less thoughful enthusiasts in the popular agitation for efficiency have failed to get the true perspective and have clamored for protection for the workers solely upon the ground that *"it pays"* the employer. Let us congratulate ourselves that those who are in danger of losing their health and their lives in their daily toil have in some instances at least that incidental advantage. But let us have less of this everlasting dinning in our ears that, before we ask for decent protection for the workers, we must first demonstrate that each advance toward health and safety will actually put *additional dollars* in the pockets of employers. Let no one forget, meanwhile, that the philosophy of mercenary profit, when carried to its logical conclusion, may result in some instances, where it is not clear that profits will respond immediately to the expense of safety, in less than decent protection. No man in this Republic should be permitted for a moment to forget that, no matter how urgent is the duty to protect the property of citizens, society has a much higher responsibility, the protection of *human life.*

In our efforts to secure the necessary information upon which to base intelligent legislation, we must draw more and more upon the expert service of the physician. Eight states have already enacted laws requiring medical reports on the most easily recognizable diseases of occupation. These reports will indicate special danger points for intensive study within industrial establishments. Periodical physical examination of workers in particularly hazardous trades is now required in one state, and the regular medical inspection of factories, now unhappily limited to three states, will undoubtedly be extended rapidly within the near future. Medical colleges might well include regular courses on industrial hygiene; hospitals, too, will be expected to improve their system of records;

and in the leading industrial centers we shall eventually have special clinics and wards for the study and prevention of industrial diseases. Recent developments indicate that the medical profession will not evade its opportunity and responsibility.

For many years it has been our shame that in this field we have lagged far behind some of the countries of Europe. Our scandalous disregard for the safety and health of workers is widely known. But in this country true reform waits not so much upon sentiment as upon facts. We are just beginning to utilize the materials at hand, and our machinery for scientific cooperation in promoting industrial hygiene is but fairly set in motion. We move rapidly when once under way. Let us press on in the hope that another generation may see America *leading* the nations of the world.

GENERAL DISCUSSION

Dr. C. T. Graham-Rogers, *Medical Inspector of Factories, New York:* Any discussion of the question of state promotion of industrial hygiene would comprise four points, first the reporting of industrial diseases, second the recording of the reports, third intensive study of the means of prevention, and fourth education. The departments of state which would naturally be responsible would be the health department, the labor department, and the educational department.

Dr. Wilbur has spoken of how the question of reporting corresponds to the registration of births. The notification of industrial diseases gives us some idea of how to make an investigation and then of how to prevent further trouble. The morbidity returns are more important than the mortality returns. Last year I went over the reports of New York State and I noticed that the mortality from pulmonary tuberculosis in a locality known for steel grinding appeared to be low, while in an essentially country district it appeared to be very high. I have visited every factory in the state and, from the known facts that I have of the steel district, these statistics are no indication whatever of the real conditions. In foreign countries the records are more complete.

In New York State the reports of occupational diseases are sent to the bureau of labor statistics. Dr. Hatch of that bureau then sends me a copy of every report that is made. These cases are followed up and when they run up to a certain number in an industry we start an intensive investigation. We try to find the cause of the occupational disease, whether it is due to dust, to fumes, to gases, or to atmospheric conditions. We try to find the exact point in the industry that is to blame. We have in New York an engineering inspector who takes up the matter with the medical inspector whenever it is a question of mechanical means for the removal of dust, fumes, and gases.

The state labor department can also take up the question of the home worker and of the child worker. In the promotion of industrial hygiene it is an important thing to know whether or not a child is fit to go into an industry. If a child is not fit to go into

a certain industry we should keep him out. The educational department can help in this work by vocational schools, by finding out what the children are fit for, and by teaching them that there are certain means to protect their health and lives and how to use these means.

Dr. Overlock, in taking up the question of education, has emphasized the instruction of physicians in medical colleges to understand and know industrial diseases when they see them. I think that is most important. I myself had an example of the need for such instruction. I went into a factory where they made storage batteries and one of the workers there had a typical case of lead poisoning and wrist-drop. I asked the foreman if he had known anything of lead poisoning. He said no, that the individual just hung around there, suffering from rheumatism and one thing and another, and that it was a matter of charity to let him do little jobs. I asked the worker if he had been to a physician and found that he was being treated for rheumatism. He was in the vicinity of the Vanderbilt Clinic, so I gave him a card and sent him over there. It was a well-marked case of lead poisoning and not rheumatism. So the statement made by Dr. Overlock is true. Some of the medical men are not instructed and do not see enough cases to be able to recognize these diseases.

Mr. Paul Kennaday, *Secretary, New York Association for Labor Legislation, New York City:* I liked particularly Dr. Overlock's suggestion with regard to tuberculosis. A tuberculosis campaign furnishes us with a standard for the whole question of industrial disease. What the people who are fighting tuberculosis have done it seems to me we should do with industrial diseases in general. The exhibition, the lecture, the printed leaflet, and the newspaper have all been used with great success in that campaign, and we should use the same means in the matter of industrial diseases.

We must get this thing over to the public. We must make them realize that there is a relation between occupation and disease, and we must not be overnice in the way we go about it. In Massachusetts they say that at one time there was a sign in Boston which stated that the public was requested not to deposit sputum upon the pavements. We said in New York, a more vulgar lot, "Don't spit", and I think the message carried over rather better.

It is the same with regard to industrial diseases. We are dealing with people many of whom are not very intelligent, who are rushed with their occupations, and who have no time for study, and we must make this message to them just as brief and just as vivid as possible. We must use the picture to a large extent and we must use the exhibition. We ought to have in every large city in this country a permanent industrial exhibition open day and night, especially on Sundays and holidays, for the education of the worker as well as the manufacturer. Then we should make use, it seems to me, of the motion picture. There are infinite possibilities there for driving home this lesson of prevention.

We must remember, too, that we must educate not only the industrial worker but the physician. If we are to believe the physicians themselves, this latter job is probably more difficult than the former. The physician looks rather askance on anything new and he is fearful of reformers. We must gain his confidence and we must not be overstrenuous in our desire to force this registration law. In New York City the law compelling registration of tuberculosis was first put on the books, then physicians were notified of it, then lectures were given; and the thing was worked up gradually among the people until it came finally to actual enforcement. By that time the law had the good-will of the majority of the medical profession.

The same method should be applied to the reporting of occupational diseases in general. But, finally, the whole thing is up to the state labor departments and not to reformers or welfare workers or employees. Our public officials are put there to do the job for us. They are our representatives, the representatives of the great body of the public, of the trade unionists and also of the men who are not organized but who are still part of the people. It is up to all of us to see that our public officials do their work honestly and with a certain amount of vision, that they do not just stick to the strict letter of the law but go out and do the thing in a whole-hearted, splendid way. In order that they may do that, it is up to us to see that they get sufficient appropriations, that they are able to pay sufficient salaries so that they can get and retain the right sort of men, and that they insist upon efficiency and do not countenance the retention in office of men who simply want to hang on to good political jobs.

Professor Henry W. Farnam, *Chairman:* I think that the form

in which the topic "State Promotion of Industrial Hygiene", is put, is calculated to awaken in the minds of many people a certain presumption against the proposition. When we talk of the state I think we are very apt to have in mind the old police state. "The state, I'm the state." We sometimes forget that we are the state, that the state is all of us in a democracy. The only question is whether this matter of industrial hygiene is sufficiently important for all of us to get together to try and put something through or whether it is a matter which can be safely left to the individual.

We have in our country a very good precedent for the action of the government in these matters. In the first decade after the adoption of the Constitution the government established a sick insurance and benefit fund for seamen. It was one of the first systems of the kind in the world. Here was a case where the government singled out a single profession or occupation, known to be particularly hazardous, and took extraordinary measures to provide for sickness. The remarkable thing is that in those early and simpler days apparently no one ever thought to contest the constitutionality of that measure, and the consequence was that it went on and we have developed a great medical system, the United States Public Health and Marine-Hospital Service, out of that small beginning which was an effort by the government to provide for the health of one particular occupation.

In connection with the very valuable suggestion thrown out by Dr. Overlock with reference to the establishment of hospitals for industrial diseases, it may be well to state that Dr. Devoto of Milan is expected to be in this country in September in attendance at the International Congress on Hygiene and Demography and I am sure I voice the sentiments of the Association in saying that we second heartily Dr. Overlock's suggestion and hope that someone who has money to give away wisely will establish such a hospital.

V

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Trial List of References

on

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Prepared by the

American Association for Labor Legislation

United States Bureau of Labor

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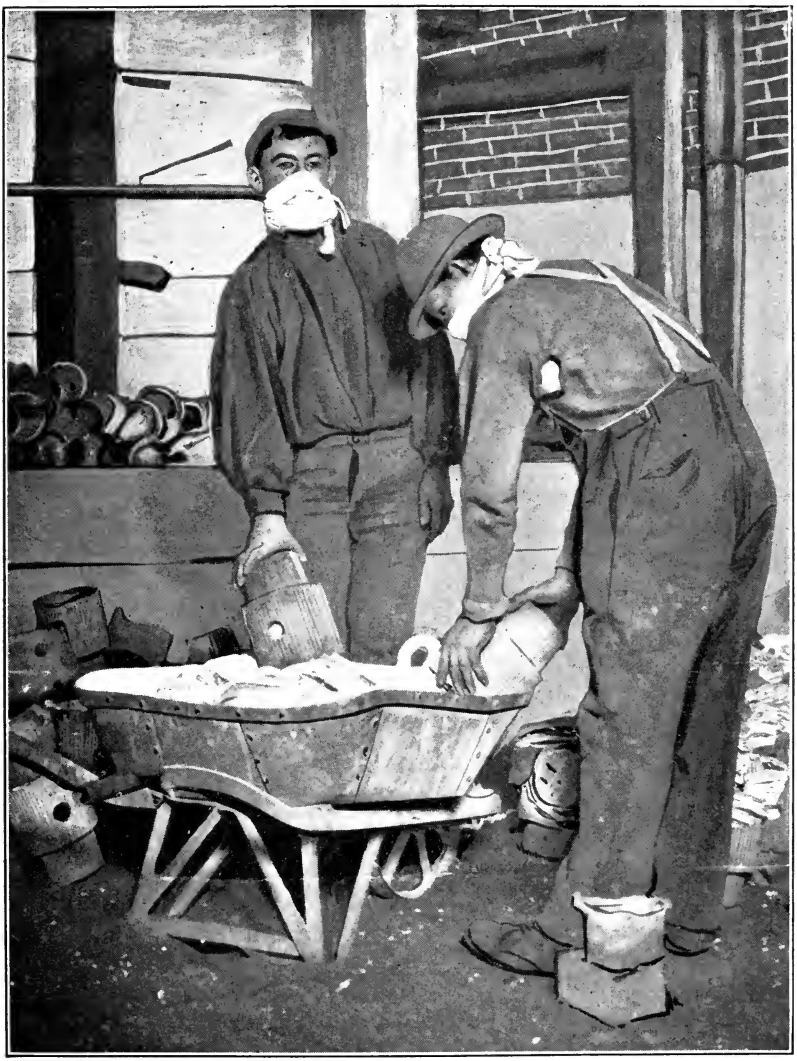

WORKERS IN WHITE-LEAD FACTORY

Removing Corroded White Lead From Jars in Which it has been Transformed from Metallic Plates by the Action of Acetic Acid. Improvised Rag Muzzles the only Protection from Death Dealing Dust

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II, p. 68-91. Albany, 1910.)
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.....An uncommon case of occupation neurosis. (Philadelphia polyclinic, March 20, 1897, v. 6: 123-124.)
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.....Fourth annual report. (In Forty-second annual report of the State board of health of Massachusetts. Boston, 1910. p. 437-556.)

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.....Massachusetts House documents no. 50, March, 1845; no. 153, 1850. (Reprinted in Documentary history of American industrial society, Cleveland, 1910, v. 8: 133-186.)
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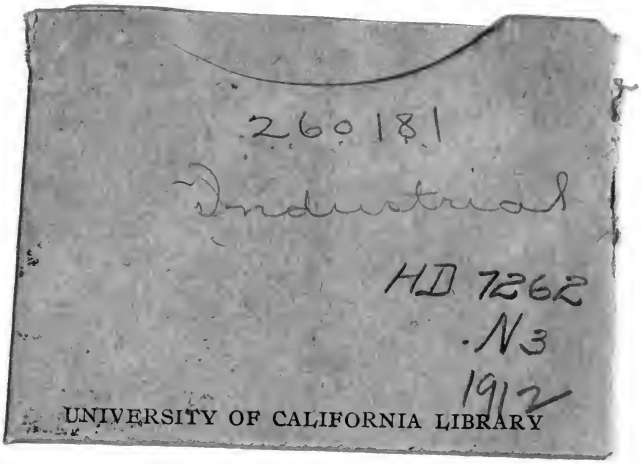
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